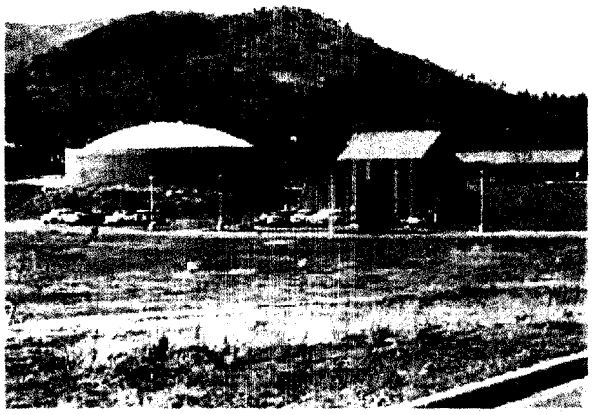
CITY OF PHOENIX
INDUSTRIAL WASTEWATER MONITORING

PHASE II PRETREATMENT LOCAL LIMITS STUDY



FINAL REPORT
June 2006

MALCOLM PIRNIE

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LIST OF ACRONYMS

AAC	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
ADRE	Average Daily Removal Efficiency
AHL	Allowable Headworks Loading
AIL	Allowable Industrial Loading
APP	Aquifer Protection Permit
AWQS	Aquifer Water Quality Standards
AZPDES	Arizona Pollutant Discharge Elimination System
BEHP	Bis (2-ethylhexyl)phthalate
BMPs	Best Management Practices
BL	Background Loading
BOD_5	Biochemical Oxygen Demand
CIU	Categorical Industrial User
CFR	Code of Federal Regulations
DF	Dilution Factor
FOG	Fats, Oil, and Grease
IU	Industrial User
lb/day	pounds per day
MAHL	Maximum Allowable Headworks Loading
MDL	Method Detection Limit
mg/kg	milligram per kilogram
mg/L	milligram per liter
mgd	million gallons per day
MRE	Mean Removal Efficiency
NAU	Northern Arizona University
NHLW	Non Hazardous Liquid Waste
NIND	Non-industrial/ Non-domestic
NSCIU	Non-Significant Categorical Industrial User
ORE	Overall Removal Efficiency
POC	Pollutant of Concern
POTW	Publicly Owned Treatment Works
PRE	Primary Removal Efficiency
PVC	Polyvinyl Chloride
RE	Removal Efficiency
RL	Reporting Limit
RREL	USEPA Risk Reduction Engineering Laboratory
SA	Safety Allowance
SF	Safety Factor
SIU	Significant Industrial User
SWQS	Surface Water Quality Standards
TSS	Total Suspended Solids
UCL	Uniform Concentration Limit
USEPA	United States Environmental Protection Agency
WEF	Water Environment Federation
WERF	Water Environment Research Foundation
WRPs	Water Reclamation Plants
WWTPs	Wastewater Treatment Plants

EXECUTIVE SUMMARY

GENERAL

Background

In 1993, the City of Flagstaff completed a major study of the Wildcat Hill Wastewater Treatment Plant (WWTP) that formed the basis for the local industrial pretreatment limits currently incorporated into the City's pretreatment ordinance. A re-evaluation was conducted in 2002, resulting in the identification of three general groups of pollutants:

- Metals and organic compounds with "interim" limit status that required additional site-specific information to develop technically defensible local limits. These pollutants included antimony, copper, cyanide, lead, mercury, selenium, silver, benzene, and bis (2-ethylhexyl) phthalate.
- Metals with "final" status that required confirmation of the site-specific removal efficiency for total chromium and the influent mass balances for zinc.
- Design parameters (i.e., five-day biochemical oxygen demand, or BOD_5, and total suspended solids, or TSS) with interim status.

Wastewater System

The Wildcat Hill WWTP (6 million gallons per day (mgd)) and Rio de Flag Water Reclamation Plant (WRP) (4 mgd) are interconnected with Rio de Flag WRP operating as a skimming plant which discharges its sludge for treatment at Wildcat Hill WWTP.

Purpose Local limits protect WWTPs from industrial discharges of pollutants in quantities that could create pass-through or interference problems or pose risks to the health and safety of WWTP and collection system workers. Pass-through occurs when pollutant concentrations or loadings in the WWTP effluent exceed quality criteria for reuse or disposal. Interference occurs when pollutants in the WWTP influent disrupt WWTP operations or performance or concentrate in biosolids to levels exceeding quality criteria for land application. Unlike federal categorical standards and general discharge prohibitions, local limits are site-specific and must take into account the quality and quantity of industrial discharges, the unique circumstances at each WWTP, and the regulatory framework of all federal, state, and local regulations.

Goal The goal of the current project is to re-evaluate the local pretreatment limits for some of the pollutants of concern, based upon local site-specific WWTP and environmental considerations as available, which would apply to both the Wildcat Hill WWTP and the Rio de Flag WRP. Specifically, the objectives of this current project were (1) to develop technically valid, effective, and enforceable

recommendations for nine pollutants, which may include a numeric limit, BMPs, and other control measures, (2) to confirm the implementation of the final limits for chromium and zinc, and (3) to evaluate the design capacity for BOD_5 and TSS. The recommendations and action plans of this current project are in addition to the 2002 Local Limits Study recommendations.

The City initiated this current project in August 2005 to incorporate the results of recent sampling, meet ADEQ requirements including the new AZPDES permits, and address the impacts of other changes and modifications since the 2002 final report.

POLLUTANTS OF CONCERN

Methodology

In the 2002 study, twenty-three pollutants of concern (POCs) were identified through comparison of WWTP and collection system pollutant concentration data to applicable effluent and sludge quality criteria, process inhibition levels, and health and safety screening levels. A given pollutant was designated as a POC if the data for a particular pollutant met the USEPA technical screening. The current project focuses on the analysis and recommendations for thirteen of the twenty-three POCs.

Special Sampling Event

In October and November 2003, sampling was conducted at the background locations, which includes the domestic and mixed commercial/domestic manholes, non-hazardous liquid waste (NHLW), and Rio de Flag WRP sludge discharges, and at the Wildcat Hill WWTP and Rio de Flag WRP. These data was used to develop the pollutant loading projections and to develop the local limits.

MAJOR CHANGES SINCE 2002 REPORT

Final AZPDES Permit

The final AZPDES permits for the Wildcat Hill WWTP and Rio de Flag WRP were issued on July 7, 2005 and July 26, 2005, respectively. In an audit report dated February 11, 2005, ADEQ required that the new AZPDES permit limitations be included in the next local limits update. The final AZPDES permit for the Wildcat Hill WWTP includes a copper interim limitation of 0.036 mg/L and a final limitation of 0.018 mg/L (effective in July 7, 2008), as well as conditions for implementing a copper reduction plan. Modifications to the pretreatment program resulting from the current project must be submitted to ADEQ within one year of the permit issue date.

ALLOWABLE HEADWORKS LOADING ANALYSES

Determination of Flows and Loads

Estimates of influent flows and loads were prepared to characterize background loadings, which reduce the pollutant load that can be allocated to industry; and to evaluate relative growth of industrial and non-industrial wastewater sources which affect the safety factor applied to allowable headworks loadings.

Allowable Headworks Loading Analyses

Allowable headworks loading analyses were conducted for nine pollutants of concern using flow and load projections for 2009. Allowable industrial loadings were allocated to the total population of industrial users according to the uniform concentration allocation method. Loadings were divided by the total projected industrial flow rate for 2009 to determine the pollutant concentration acceptable for discharge given the site-specific conditions and literature values at the Wildcat Hill WWTP and the Rio de Flag WRP. Concentration limits were calculated and evaluated to determine the feasibility for implementation. In addition, analyses were performed for chromium and zinc to confirm the 2002 recommendations.

Maximum Allowable Headworks Loading-based local limits are recommended for cyanide, lead, mercury, silver, and zinc. Maintaining the current local limits for copper is recommended until the copper reduction plan is implemented. MAHL-based limits are not necessary for antimony, chromium, selenium, benzene, and bi(2-ethylhexyl)phthalate.

OTHER CONTROL STATEGIES

Best Management Practices

Best management practices (BMPs) are useful when there is no local limit for a particular pollutant currently in place, the discharging industrial users have been identified, and/or the proposed local limit is not technologically achievable. BMP development and implementation is recommended for bis (2-ethylhexyl)phthalate.

An updated copper local limit based on new site-specific data could not be recommended because the background loadings to both plants are high and reduce the available loadings for industrial users. After the City's copper reduction plan for background sources is developed and implemented, additional sampling and recalculation of limits is necessary. Promotion of copper reduction through BMPs or treatment at the industries is recommended.

Fume Toxicity Screening Level

Fume toxicity screening level to protect worker health and safety was

recommended for benzene, which did not qualify for a local limit based on effluent criteria.

Design Capacities

BOD_5, and TSS, were evaluated based on design loadings to the plants. The 2003 influent BOD_5 and TSS loadings to Wildcat Hill WWTP exceed current design capacities, but are well within proposed design capacities. The current loadings to the Rio de Flag WWTP are well within existing design capacities. As long as the Wildcat Hill WWTP is upgraded, more stringent controls are not required at this time.

SUMMARY OF INDUSTRIAL CONTROL STRATEGIES

The recommendations for the 13 POCs are summarized in the following table:

Table ES.1 – Recommended Industrial Control Strategies

Pollutant	Current Local Limit	Recommendations
Metals		
Antimony	No Limit	No Limit
Chromium (Total)	No Limit	No Limit
Cyanide (Total)	0.24 mg/L	0.24 mg/L
Copper	1.0 mg/L	1.0 mg/L and Background Loading Reduction Program
Lead	0.98 mg/L	0.041 mg/L
Mercury	0.030 mg/L	0.017 mg/L
Selenium	No Limit	No Limit
Silver	0.72 mg/L	0.30 mg/L
Zinc	1.4 mg/L	1.4 mg/L
Volatile Organic Compounds		
Benzene	Prohibited	0.35 mg/L
Semi Volatile Organic Compounds		
BEHP	No Limit	BMPs
Conventional Pollutants		
BOD_5	1,000 mg/L	1,000 mg/L
TSS	1,200 mg/L	1,200 mg/L

The recommendations and action plans of this current project are in addition to the 2002 Local Limits Study recommendations.

1

1.0 INTRODUCTION

1.1 PROJECT BACKGROUND

In 2000, the City of Flagstaff (City) undertook the re-evaluation of the development of technically based local industrial discharge limitations (local limits) for the Wildcat Hill Wastewater Treatment Plant (WWTP) and the Rio de Flag Wastewater Reclamation Plant (WRP). The final report for this study [1], issued in June 2002, defined three general groups of pollutants:

- Metals and organic compounds with "interim" limit status. Metals and organics with interim limit status required additional site-specific information to calculate background loadings, influent mass balances, removal efficiencies, treatment plant mass balances, maximum allowable headworks loadings, and/or uniform concentration limits. These pollutants included antimony, copper, cyanide, lead, mercury, selenium, silver, benzene, and bis (2-ethylhexyl)phthalate (BEHP).
- Metals with "final" status that required confirmation of specific items. Two metals with final limit status, chromium and zinc, required additional site-specific monitoring prior to the next local limits update to confirm or update the results of analyses conducted as part of the 2000 local limits study.
- Design parameters (i.e., five-day biochemical oxygen demand, or BOD_5, and total suspended solids, or TSS) with interim status.

In accordance with the recommendations of the final report, the City initiated a special sampling event in 2003 to collect site-specific sampling and flow monitoring data. Additional data for chromium and significant industrial users were collected in 2004 and 2005 as part of the routine sampling.

In February 2005, the Arizona Department of Environmental Quality (ADEQ) issued an audit response based on a Pretreatment Compliance Audit of the City's pretreatment program conducted on November 2004, requiring the City to establish local limits for the pollutants specified in the new ADEQ Arizona Pollution Discharge Elimination System (AZPDES) permits. The audit response required the City to calculate local limits for the Wildcat Hill WWTP and the Rio de Flag WRP based on its new AZPDES effluent limits, inhibition criteria, and removal capability and to compare the calculated limits with the revised limits recently adopted.

In addition, since the 2002 local limits report was issued, there have been modifications to the wastewater collection and treatment system, as well as changes in the quality and quantity of wastewater discharges to the Wildcat Hill.

The City initiated the current project in August 2005 to:

- Incorporate the results of recent sampling
- Meet ADEQ requirements
- Address the impacts of other changes and modifications since the 2002 final report

1.2 PROJECT PURPOSE

Local limits protect publicly owned treatment works (POTWs) from industrial discharges of pollutants in quantities that could create *pass-through* or *interference* problems or pose risks to the health and safety of collection system and POTW workers. *Pass-through* occurs when pollutant concentrations or loadings in the POTW effluent exceed quality criteria for reuse or disposal. *Interference* occurs when pollutants in the POTW influent disrupt WWTP operations or performance or concentrate in biosolids to levels exceeding quality criteria for reuse or disposal.

Unlike other elements of the National Pretreatment Program (i.e., Federal categorical standards and general discharge prohibitions), local limits are site-specific and must take into account the quality and quantity of industrial discharges, the unique circumstances at each POTW, and the regulatory framework of all Federal, State, and local regulations.

Local limits are typically applied to significant industrial users (SIUs), as defined in 40 Code of Federal Regulations (CFR) Part 403. The SIUs meet one or more of the following criteria:

- Industries subject to Categorical Pretreatment Standards, with the exceptions noted below.
- Industries discharging 25,000 gallons per day or more of process water (excluding sanitary, non-contact cooling, and boiler blowdown wastewater). If an industry meets only this criterion and its process water does not contain pollutants of a concern (POCs), a municipality may choose to exempt it from meeting local limits.
- Industries contributing five percent or more of the average dry weather hydraulic or organic capacity of the POTW.
- Industries having a reasonable potential for adversely affecting the POTW or for violating any criteria or requirement.

The Final Rule for Streamlining the General Pretreatment Regulations for Existing and New Sources of Pollution (40 CFR Parts 9, 122, and 403, or the Pretreatment Streamlining Rule) was promulgated by USEPA for judicial review purposes on October 28, 2005, and became effective November 14, 2005. The Pretreatment Streamlining Rule created an exception to classify all categorical industrial users (CIUs) as SIUs by establishing a new class of discharger, the "non-significant categorical Industrial User (NSCIU)." A NSCIU

discharges no more than 100 gpd of total categorical wastewater to the POTW. A POTW may choose to treat qualifying CIUs as NSCIUs, reducing oversight requirements to annual certification, with no other control mechanism, reporting, or inspection/sampling requirements.

Each POTW receives a unique mix of wastewater from a variety of sources, including industrial users and background sources, such as domestic and commercial. The relative quantities contributed by these sources vary from pollutant to pollutant, with the greater portion of some pollutant loadings being discharged by industrial sources and others by background sources.

Numeric local limits, such as those currently enforced as part of the City's pretreatment ordinances, are effective for controlling many pollutants discharged by industrial users. In certain cases, however, they are not effective at managing industrial pollutant discharges. For example, the industrial contribution of a pollutant may be relatively small in comparison to the background loading, thus minimizing the amount of control a local limit on industrial users has on the WWTP influent loading. Another example is a pollutant that may not be amenable to industrial pretreatment, such as bis (2-ethylhexyl) phthalate, thus reducing the achievability or effectiveness of a local limit on certain industries. In these cases, other control measures, including the use of best management practices (BMPs), may be preferred over a numeric limit.

The recommendations of the 2002 Local Limits Study [1] local limits are summarized in Table 1.1, including the status (i.e., final or interim) of the limit.

Table 1.1 - Summary of 2002 Local Limits Study Recommendations

Pollutant	Proposed Local Limit (ug/L) (1)	Status of Proposed Local Limit
Metals and Inorganic Compounds		
Antimony	No Limit	Interim
Arsenic	260	Final
Chromium	No Limit	Final
Cyanide (total)	240	Interim
Copper	1,000	Interim
Lead	980	Interim
Mercury	30	Interim
Nickel	No Limit	Final
Selenium	No Limit	Interim
Silver	720	Interim

Table 1.1 - Summary of 2002 Local Limits Study Recommendations (Cont.)		
Pollutant	**Proposed Local Limit (ug/L) (1)**	**Status of Proposed Local Limit**
Metals and Inorganic Compounds		
Zinc	1,400	Final
Purgeables (Volatile Organics)		
Benzene	Prohibited	Interim
Methylene Chloride	4,100	Final
Toluene	4,200	Final
Base/Neutrals		
Bis (2-ethylhexyl)phthalate	No Limit	Interim
Pesticides and PCBs		
4,4'-DDD	Prohibited	Final
4,4'-DDE	Prohibited	Final
4,4'-DDT	Prohibited	Final
Heptachlor	Prohibited	Final
Others		
BOD_5	1,000 mg/L	Interim
Nitrogen (Nitrate-N)	No Limit	Final
PH	Upper: 12.5	Final
	Lower: 5.0	
Total Suspended Solids	1,200 mg/L	Interim
Petroleum Hydrocarbons	No Limit	Final

Notes:
(1) Units are in ug/L unless otherwise stated.

The goal of the current project was to re-evaluate the uniform set of local limits that apply to both the Wildcat Hill WWTP and the Rio de Flag WRP, taking into account the changes that have occurred since the 2002 report was issued and using the additional sampling data collected by the City in 2003, 2004, and 2005. Specific objectives included the following:

- Incorporating the final effluent criteria from the Arizona Pollutant Discharge Elimination System (AZPDES) permits for Wildcat Hill WWTP and the Rio de Flag WRP in the local limits calculations.
- Updating the nine local limits defined as "interim" in the 2002 report (i.e., for antimony, copper, cyanide, lead, mercury, selenium, silver, benzene, and bis(2-ethylhexyl)phthalate).
- Performing an influent mass balance on zinc to confirm or update the 2002 recommendation of 1.4 mg/L.
- Analyzing the removal efficiency for chromium to confirm or update the 2002

recommendation of no limit.

- Performing influent mass balances for five-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) and comparing to WWTP design capacities.

1.3 PROJECT METHODOLOGY AND REPORT ORGANIZATION

Sampling data from the 2003 sampling events were used as the basis for this study. Where appropriate, the 2003 data were supplemented by sampling data from 2004 to 2005, by sampling data from 1999 to 2001 used in the 2002 Local Limits Study [1], and by historic sampling data from the 1993 Local Limits Study [2].

The project methodology was based upon general information provided by the 2004 USEPA Local Limits Development Guidance [3]. The project approach described in this report includes the following elements:

- Review of changes in the wastewater collection and treatment system, in industrial users, and in environmental criteria and regulatory requirements and of the 2003 sampling data
- Evaluation of flows and loads
- Development of allowable headworks loadings at the Wildcat Hill WWTP and the Rio de Flag WRP
- Development of local limits by the uniform concentration method
- Evaluation of BOD_5 and TSS

2.0 CHANGES SINCE THE 2002 FINAL REPORT

2.1 GENERAL

Recalculating local limits is necessary when there are modifications to the wastewater collection and treatment system, revisions to environmental criteria and regulatory requirements, or changes in the quantity or quality of wastewater discharged to the system. Since the final report for the 2002 Local Limits Study [1] was issued, changes have occurred in each of these areas that warrant re-evaluation of the local limits. The following sections document these changes, as well as the special sampling event conducted by the City in 2003 to collect additional data.

2.2 WASTEWATER COLLECTION AND TREATMENT SYSTEM

The City of Flagstaff owns and operates two wastewater treatment facilities, the Wildcat Hill WWTP and the Rio de Flag WRP. The Wildcat Hill WWTP is a 6 million gallon per day (mgd) tertiary treatment facility producing Class B effluent. Major treatment processes include primary sedimentation, biofiltration, secondary sedimentation, chlorine disinfection, sulfur dioxide dechlorination, and sand filtration for main stream treatment. Treated effluent is discharged seasonally to the Continental Country Club for reuse irrigation. When not in demand, effluent is discharged to surface waters at Rio de Flag (Outfall 001), Lake Humphrey (Outfall 002), Lower Walnut Canyon (Outfall 003), and Whale Lake (Outfall 004). Sludge is processed in anaerobic digestion facilities prior to land injection at a dedicated site.

The Rio de Flag WRP is a 4 mgd facility which has been in operation since 1993, producing Class A+ effluent. The Rio de Flag WRP operates as a skimming plant upstream of Wildcat Hill WWTP. Major processes include primary sedimentation, nitrifying/denitrifying activated sludge, secondary sedimentation, dual media filtration, and ultraviolet (UV) disinfection. Sludge is transferred through the collection system to the Wildcat Hill WWTP for treatment. Reclaimed water is used for irrigation of public areas. The Rio de Flag facility will also discharge to the Rio de Flag outfall when irrigation demand is low.

In 2004, Black & Veatch, as consultants to the City, recommended improvements to Wildcat Hill WWTP to improve effluent quality from Class B to Class A+ and to Rio de Flag WRP to allow for redundancy, expandability, and improved effluent quality [4]. The proposed liquid stream improvements at the Wildcat Hill WWTP included the following:

- Rehabilitation of the existing primary clarifiers.
- Conversion of the existing biotowers to flow equalization basins.
- Conversion of the existing trickling filters to integrated fixed film activated sludge

reactors.

- Upgrade of the existing secondary clarifiers.
- Replacement of the existing dual-media filters with disk filters.
- Construction of a new grease receiving station and a new septage sidestream treatment facility for equalization and preliminary treatment of grease and septage.

At Rio de Flag, the proposed liquid stream improvements consisted of replacement of the existing dual-media filters with disk filters. The City intends to implement the recommended improvements at both plants. All new facilities should be operational by mid-2007. For future local limits updates, it is recommended that a sampling and analyses plan be developed and implemented to update the removal efficiencies at each plant after the new treatment facilities are operational.

2.3 INDUSTRIAL USERS

There are 13 SIUs in the combined service area for the Wildcat Hill WWTP and Rio de Flag WRP, as presented in Figure 2.1. These SIUs include manufacturing and processing industries which make a variety of products, including paper products, pet food, soft drinks, ice cream cones, and surgical supplies; other users include an industrial laundry, a hospital, and Northern Arizona University (NAU). Table 2.1 provides the data summary for each SIU.

Due to the configuration of the wastewater collection system, the Rio de Flag WRP receives contributions from the following SIUs:

- NAU - Dome
- NAU - Biology
- NAU - Chemistry (outfall closed)
- NAU - Biochemistry
- Flagstaff Medical Center
- W.L. Gore - Woody Mountain
- W.L. Gore - Echo Ridge
- Joy Cone

In addition to the SIUs that discharge to the Rio De Flag WRP, with the exception of Joy Cone, the Wildcat Hill WWTP also receives industrial contributions from the following SIUs:

- SCA Tissue

- Mission Linen & Uniform (Huntington Drive)
- Nestle Purina
- Pepsi Cola Bottling Company
- W.L. Gore - 4th Street

SCA Tissue has changed their configuration of discharging their recycling stream. The SIU uses reclaimed water from the Rio de Flag WRP and beginning in January 2006, began to discharge approximately 80 percent of their recycling water to the Rio de Flag WRP and 20 percent to the Wildcat Hill WWTP instead of 100 percent to the Wildcat Hill WWTP.

2.4 ENVIRONMENTAL CRITERIA AND REGULATORY REQUIREMENTS

In an audit report dated February 11, 2005, ADEQ accepted the 2002 local limits but required that the new AZPDES permit limitations for the Wildcat Hill WWTP and the Rio de Flag WRP be included in the next local limits update. The 2005 Local Limits Study and any modifications to the pretreatment program resulting from them must be submitted to ADEQ within one year of the permit issue date (June 15, 2005 for the Wildcat Hill WWTP and July 18, 2005 for the Rio de Flag WRP). The new permit limits are summarized in Appendix A with other relevant environmental criteria. The expiration dates for these permits are July 7, 2009 for Wildcat Hill WWTP and July 26, 2009 for Rio de Flag WRP.

Under Part V. Special Conditions, A. Compliance Schedule, the Wildcat Hill WWTP AZPDES permit describes the City's requirement of developing and implementing a plan to reduce the facility's effluent concentrations of copper to meet the new copper limits that will go into affect three years (i.e., July 7, 2008) after the effective date of the permit. Appendix A contains the excerpt from the permit.

2.5 2003 SPECIAL SAMPLING

This section presents an overview of the special sampling event conducted by the City in 2003, as well as routine sampling conducted in 2004 and 2005.

2.5.1 Background Sampling

Sampling of wastewater discharged by background sources included the following types:

- Domestic
- Non-industrial/non-domestic (NIND)
- Non-hazardous liquid waste (NHLW)

- Rio de Flag WRP sludge

Domestic and NIND samples were drawn from manholes identified by City staff as representative locations for domestic sources and NIND sources, as presented in Table 2.2. The metals, BOD_5 and TSS analyses were performed on 24-hour time-weighted composite samples. The benzene analyses were performed on grab samples. Domestic sampling data were collected from a manhole in the Cheshire subdivision and from a manhole in the interceptor that runs along University. The Cheshire and University domestic manholes were sampled for 7 consecutive days from October 1 through October 7, 2003. NIND sampling data were collected from a manhole in the interceptor that runs along Railroad Avenue and collects wastewater from a large shopping mall, among other sources. The Railhead manhole was sampled for 7 consecutive days from October 2 through October 8, 2003. Chromium was not analyzed in samples collected during the October 2003 sampling events because background values did not need to be verified, only removal efficiencies at the plants.

Table 2.2 - Manhole Sampling Location Descriptions

Location	Manhole ID	Service Area Type	Service Area Description	Age [1]	Socioeconomic Conditions [2]
Cheshire	1A-048	Domestic only	Single family residences	All	Upper
University	5-400	Domestic only	Single family residences and apartments	All	Upper
Railhead	20-981	Mixed commercial and domestic	Single family residences, apartments, shopping mall, restaurants, grocery store	Medium to Old	Lower/Middle

Notes:
(1) Old = >30 years; Medium = 10 - 30 years; New = < 10 years; All includes Old to New
(2) Census breakdown for median income: Low =<$18,494 / year; Lower/Middle = $18,494-$24,451 / year; Middle = $24,451-$30,644 / year; Upper/Middle = $30,644-$39,987 / year; Upper =>$39,987 / year

Non-hazardous liquid waste (NHLW) samples were collected during the sampling event conducted in October 2003 for 7 days, on October 1 through 3, October 6 through 7, and October 9. Grab samples were taken of each truck and composited in the field for analyses at the laboratory. 24-hour, time-weighted composite samples of Rio de Flag WRP sludge, which is discharged to the sewer for treatment at the Wildcat Hill WWTP, were collected during the sampling event conducted in November 2003 for 7 days, on November 7 and November 9 through 14.

2.5.2 Industrial User Sampling

No specific SIU sampling occurred during the 2003 special sampling event. The sampling results used in this study were from the City's routine monitoring and SIUs' self-monitoring samples. Wastewater samples were collected from these SIUs between January 2004 and August 2005, with the exception of W.L. Gore - Echo Ridge (mostly domestic discharges). This time period typically includes 6 to 7 quarters of local limits sampling analyses for each SIU.

2.5.3 WWTP Sampling

24-hour flow-weighted composited or grab samples from the Wildcat Hill WWTP were collected and analyzed during the sampling event conducted in October 2003. Collection of influent and effluent samples was staggered to take into account treatment detention time. Influent samples were collected on October 14, October 17 through 19, October 22, and October 28 and 29. Effluent samples were collected on October 15, October 18 through 20, October 23, and October 29 and 30. The influent and effluent samples were scheduled to be taken over 7 consecutive days. Due to issues with sampling equipment, the 7 days were not consecutive. Sludge to disposal samples were collected for three days on October 21, 22, and 23 during this period. Chromium samples were not collected during the special sampling event; therefore chromium samples were collected from January 2004 to July 2005.

24-hour flow-weighted composited or grab samples from the Rio de Flag WRP, except for total chromium, were collected during the sampling event conducted in October 2003. Collection of influent and effluent samples was staggered to take into account treatment detention time. Influent samples were collected on November 3 through 9; effluent samples on November 4 through 10. Sludge samples were collected on November 7 and November 9 through 14. Chromium samples were collected from January 2004 to July 2005.

Table 2.1 - Data Summary for SIUs					
SIUs	**Description**	**SIC Code**	**Flagstaff Industry Status (1)**	**Change in Status since 2002**	**Change in Process since 2002**
SCA Tissue	Paper Products	2621	CIU	None	No changes.
Northern Arizona University - Dome (Sinclair Wash)	University	8221	SIU	None	No changes.
Northern Arizona University - Biology (Wettaw)	University	8221	SIU	Includes former Chemistry outfall	Acid neutralization system operational in September 2005.
Northern Arizona University - Chemistry	University	8221	SIU	Outfall closed.	Outfall closed.
Northern Arizona University - Biochemistry (Beaver/Ellery)	University	8221	SIU	None	No changes.
Flagstaff Medical Center	Hospital	8062	SIU	None	No changes.
Mission Linen & Uniform (Huntington Drive)	Industrial Laundries	7218	SIU	None	No changes.
Nestle Purina	Cat & Dog Food	2047	SIU	Change in name (formerly called Ralston Purina)	No changes.
Pepsi Cola Bottling Company	Carbonated Beverages	2086	SIU	None	No changes.
Joy Cone	Ice Cream Cone Manufacturing	2052	SIU	Change in City status from Major IU to SIU	New pretreatment facility (rotary drum vacuum) installed in Nov 2003.
W.L. Gore - Woody Mountain	Surgical Supplies	3842	Major IU	None	No changes.
W.L. Gore - Echo Ridge	Surgical Supplies	3842	Major IU	None	No changes.
W.L. Gore - 4th Street	Surgical Supplies	3842	Major IU	None	No changes.

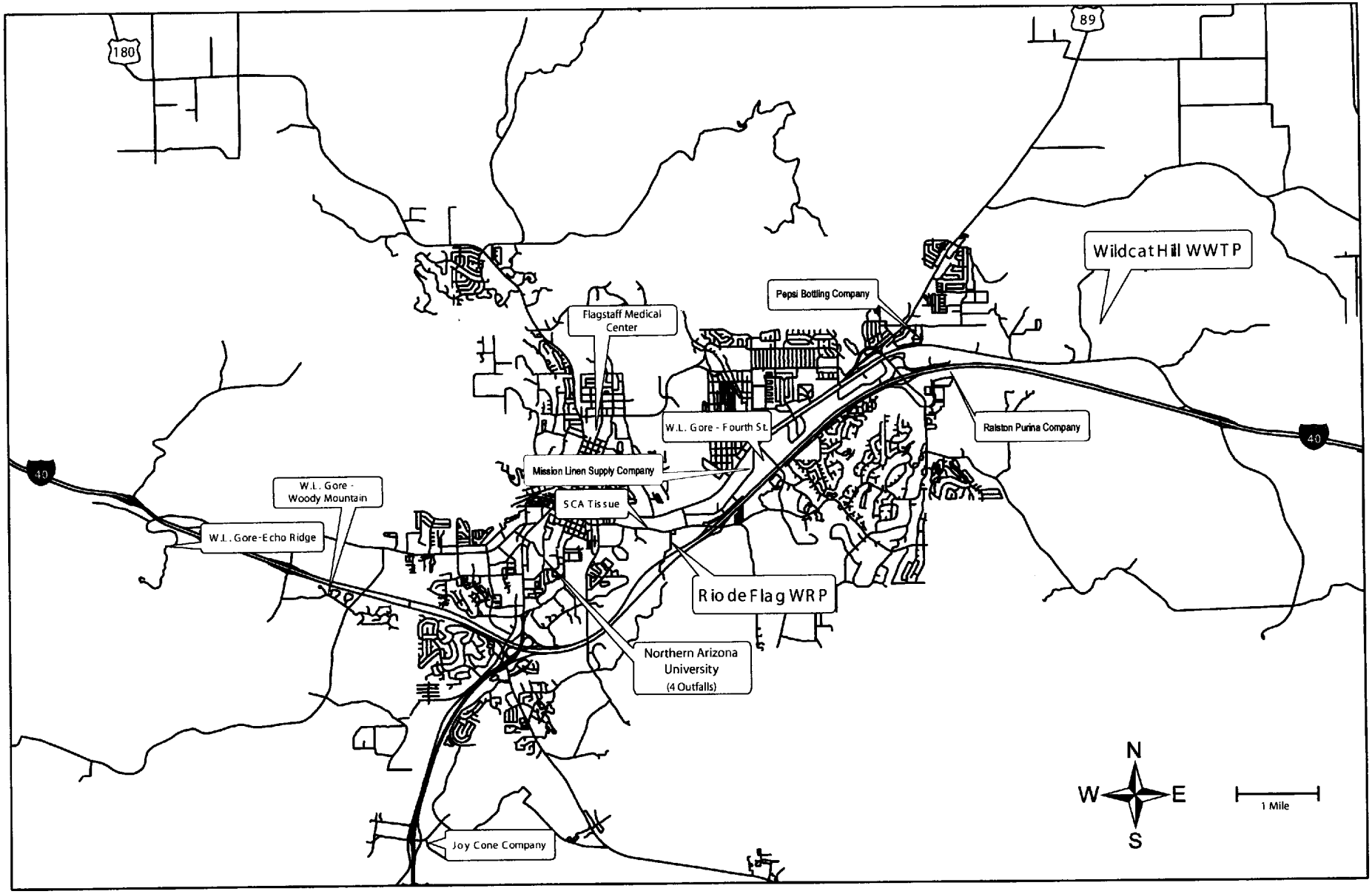
Notes:

(1) Industry status from City of Flagstaff 2004 Pretreatment Annual Report.

IU = Industrial User

CIU = Categorical Industrial User

SIU = Significant Industrial User



Provided by the City of Flagstaff

MALCOLM PIRNIE	Phase II Pretreatment Local Limits Study	Industrial Discharge Locations	MALCOLM PIRNIE, INC. Figure 2-1

3.0 DATA SOURCES

3.1 GENERAL

This section presents an overview of sampling data for 11 POCs at each sampling location, including background sources, SIUs, the Wildcat Hill WWTP, and the Rio de Flag WRP. The data evaluation and discussion for BOD_5 and TSS are presented in Chapter 7.

3.2 METHODOLOGY

The analytical data and reporting limits (RLs) were evaluated for the following locations:

- Domestic manholes: Cheshire and University
- Mixed commercial/domestic manhole: Railhead
- NHLW
- Rio de Flag WRP influent, effluent, and sludge
- Wildcat Hill WWTP influent and effluent

Mean concentrations were calculated for the POCs that had at least one detected result using the detected results and data substitutions, when necessary. Data substitution was performed using the following logic: if the pollutant was not detected in any samples from a given sampling location, the mean concentration was assumed to be zero. In the case where there were both detected and non-detected results for a POC, then non-detected results were replaced with ½ the RL for purposes of calculating the mean. If updated limits were recommended, confirmation of the substitution assumption was performed through mass balances.

3.3 BACKGROUND SOURCES

Background contributions consist of wastewater discharges from residential, commercial, institutional, and non-significant industrial users and sludge discharges from Rio de Flag WRP. For this evaluation, the residential users were grouped as domestic sector and sources identified as retail, office, public, and institutional were grouped as NIND sector.

Background contributions for the Wildcat Hill WWTP consist of wastewater discharges from domestic and NIND sectors, NHLW, and Rio de Flag WRP sludge. For the Rio de Flag WRP, background contributions consist of wastewater discharges from domestic and NIND sectors.

3.3.1 Domestic and NIND Sectors

The 2004 USEPA Guidance Manual [3] recommends characterizing background contributions through site-specific monitoring conducted on sewer trunk lines that receive wastewater solely from these sources.

The following locations and sampling data were used for the characterization of the domestic and NIND contributions to the Wildcat Hill WWTP and the Rio de Flag WRP:

- Cheshire and University domestic manholes sampled from October 1 through October 7, 2003.
- Railhead mixed commercial/domestic manhole sampled from October 2 through October 8, 2003.

Sampling results from the Cheshire and University domestic manholes were used to estimate the average pollutant concentrations for the domestic sector, while the results from Railhead manhole were averaged to represent the pollutant concentrations from the NIND sector. The average concentrations are presented in Table 3.1.

Table 3.1 - Pollutants of Concern – Domestic and NIND Concentrations (mg/L)

Pollutant	Domestic Manholes			Railhead Mixed Commercial/ Domestic Manhole	Average NIND
	Cheshire	University	Average		
Metals					
Antimony	0	0	0	0	0
Cyanide (Total)	0	0	0	0	0
Copper	0.061	0.076	0.069	0.083	0.083
Lead	0.0017	0.00097	0.0013	0.0020	0.0020
Mercury	0.00012	0	0.000062	0	0
Selenium	0.0012	0.0012	0.0012	0.0014	0.0014
Silver	0	0	0	0	0
Zinc	0.13	0.14	0.14	0.16	0.16
Volatile Organic Compounds					
Benzene	0	0.00063	0.00031	0	0
Semi Volatile Organic Compounds					
BEHP	0.022	0.024	0.023	0.12	0.12

Notes:

NA = Not Analyzed

0 = Non-detected results were given the value of zero in the calculation of averages if the pollutant was not detected in any samples from a given source. The reporting limits used for antimony, cyanide, and silver were 0.001 mg/L, 0.0097 mg/L, and 0.001 mg/L, respectively.

The estimated average domestic and NIND concentrations were different from those selected in the 2002 study, with the exception of antimony. Domestic and NIND concentrations that increased from the previous study include copper, selenium, zinc,

benzene, and BEHP. The concentrations that decreased from the previous study include cyanide, lead, mercury, and silver. These differences between the average concentrations based on 2003 data and the values used in the previous study may be due to:

- More updated and site-specific data (e.g., copper, selenium, and zinc)
- Improved RLs that allow for measuring lower concentrations (e.g., mercury and lead)
- Higher concentrations for the mixed commercial/domestic manhole (e.g., BEHP)

3.3.2 NHLW

NHLW currently accepted for treatment at the Wildcat Hill WWTP consists of wastes from residential septic tanks and portable toilets. The average concentrations of POCs in NHLW were based on the mean of sampling results collected during the sampling event conducted in October 2003, and are summarized in Table 3.2.

Table 3.2 - Pollutants of Concern – NHLW Concentrations (mg/L)

Pollutant	Average Concentrations
Metals	
Antimony	0.010
Cyanide (Total)	0.0075
Copper	2.9
Lead	0.099
Mercury	0.012
Selenium	0.028
Silver	0.0061
Zinc	12
Volatile Organic Compounds	
Benzene	0.0033
Semi Volatile Organic Compounds	
BEHP	0.18

Notes:
NA = Not Analyzed

3.3.3 Rio de Flag WRP Sludge

The average concentrations of POCs in the Rio de Flag WRP sludge were based on the mean of sampling results collected during the sampling event conducted in November 2003, and are presented in Table 3.3.

Table 3.3 - Pollutants of Concern – Rio de Flag WRP Sludge Concentrations (mg/L)	
Pollutant	**Average Concentrations**
Metals	
Antimony	0
Total Chromium	0.024
Cyanide (Total)	0
Copper	0.48
Lead	0.024
Mercury	0.00097
Selenium	0
Silver	0.056
Zinc	0.70
Volatile Organic Compounds	
Benzene	0
Semi Volatile Organic Compounds	
BEHP	0.019

Notes:
0 = Non-detected results were given the value of zero in the calculation of averages if the pollutant was not detected in any samples from a given source. The reporting limits used for antimony, cyanide, selenium, and benzene were 0.001 mg/L, 0.0097 mg/L, 0.005 mg/L, and 0.001 mg/L, respectively.

3.4 SIGNIFICANT INDUSTRIAL USERS

Wastewater samples were collected from the SIUs quarterly between January 2004 and August 2005, with one exception. No recent sampling has occurred at W.L. Gore - Echo Ridge. Thus, the previously reported sampling results from the period between January 1999 and November 2001 were used to characterize this SIU. The average pollutant concentrations from the SIUs are summarized in Table 3.4.

3.5 WASTEWATER TREATMENT PLANTS

The average influent and effluent concentrations of each POC from both treatment plants are summarized in Table 3.5. The number of samples collected, number of detected results (e.g., concentration results above the RLs), and average concentration of each POC were used to assess the quality of the data set and characterize the POC levels measured at the Wildcat Hill WWTP and Rio de Flag WRP.

3.5.1 Wildcat Hill WWTP

The average influent and effluent concentrations for the Wildcat Hill WWTP, except for total chromium, were estimated based on the mean of sampling results collected during the sampling event conducted in October 2003. Average chromium concentrations are based on the mean of sampling results collected from January 2004 to July 2005.

The average pollutant influent concentrations at Wildcat Hill WWTP were different from those observed for the data sets used in the 2002 study, with the exception of copper and silver. Pollutant concentrations that increased from the previous study include mercury and BEHP, both having six of the seven results detected above the RLs. The average concentrations that decreased from the previous study include chromium, cyanide, lead, selenium, and zinc. These differences between the average concentrations based on 2003 data and the values used in the previous study may be due to improved RLs that allow for measuring lower concentrations and higher number of samples within the data set (e.g., seven consecutive days in this study instead of four or five in the 2002 study).

Total chromium, lead, mercury, selenium, and silver were detected at very low levels (i.e., close to the RL) in the WWTP influent and were not detected in the effluent samples. In addition, total chromium and selenium were detected in a fewer number of samples than in the previous study, and data substitution (with ½ RL) was used for the non-detected results to calculate the average concentrations on multiple occasions.

3.5.2 Rio de Flag WRP

The average influent and effluent concentrations for the Rio de Flag WRP, except for total chromium, were estimated based on the mean of sampling results collected during the November 2003 sampling event. Average total chromium concentrations are based on the mean of results collected from January 2004 to July 2005.

The average pollutant influent concentrations at Rio de Flag WRP were different from those selected in the 2002 study, with the exception of cyanide and copper. Pollutant concentrations that increased from the previous study include chromium and BEHP. The average concentrations that decreased from the previous study include antimony, lead, mercury, selenium, silver, and zinc. These differences between the average concentrations based on 2003 data and the values used in the previous study may be due to improved RLs that allow for measuring lower concentrations for some pollutants and higher number of non-detected results for other pollutants.

Antimony, total chromium, mercury, and benzene were not detected in the influent and effluent samples. Selenium, silver, and BEHP were detected at very low levels (i.e., close to the RL) in the WWTP influent and were not detected in the effluent samples. In addition, total chromium and selenium were detected in a fewer number of samples than in the previous study, and data substitution (with ½ RL) was used for the non-detected results to calculate the average concentrations on multiple occasions.

Table 3.4 - Pollutants of Concern - SIU Concentrations (mg/L)

Pollutants	SIUs Discharging to Rio de Flag WRP and Wildcat Hill WWTP								SIUs Discharging to Wildcat Hill WWTP				
	Northern Arizona University - Dome	Northern Arizona University - Biology	Northern Arizona University - Chemistry	Northern Arizona University - Biochemistry	Flagstaff Medical Center	W.L. Gore - Woody Mountain	W.L. Gore - Echo Ridge [1]	Joy Cone [2]	SCA Tissue	Mission Linen & Uniform (Huntington Dr.)	Nestle Purina	Pepsi Cola Bottling Company	W.L. Gore - 4th Street
Metals													
Antimony	0	0	closed	0	0	0	0	0	0	0.012	0.0027	0	0
Copper	0.062	0.24	closed	0.064	0.099	0.11	0.063	0.066	0.012	0.32	0.17	0.077	0.040
Cyanide (Total)	0	0.012	closed	0	0.0087	0	0	0.014	0.0093	0	0.0079	0	0
Lead	0.0061	0.0041	closed	0.0087	0.0013	0.017	0	0.0069	0	0.050	0.018	0.0054	0
Mercury	0.00044	0.0025	closed	0	0	0.00030	0	0	0	0.00014	0.00073	0	0
Selenium	0	0	closed	0.0013	0	0	0	0	0	0	0.0012	0.0014	0
Silver	0.012	0.012	closed	1.1	0.0074	0	0	0	0	0.0017	0	0	0
Zinc	0.14	0.054	closed	0.15	0.089	0.17	0.035	0.16	0.035	0.61	0.75	0.34	0.11
Volatile Organic Compounds													
Benzene	0	0	closed	0	0	0	0	0.011	0	0	0.0018	0	0
Semivolatile Organic Compounds													
BEHP	0.023	0.014	closed	0.034	0.058	0.028	0.009	0	0	0.45	0.20	0.038	0

Notes:

Data for most SIUs was collected quarterly between January 2004 and August 2005, with exceptions noted below.

0 = Non-detects were given the value of zero in the calculation of averages if the pollutant was not detected in any samples from a given source.

(1) Data for W.L. Gore - Echo Ridge was collected between January 1999 and November 2001.

(2) Joy Cone only discharges to Rio de Flag WRP.

Table 3.5 - Pollutants of Concern Concentrations for Wildcat Hill WWTP and Rio de Flag WRP												
Pollutant	Wildcat Hill WWTP [1]						Rio de Flag WRP [2.]					
	Influent			Effluent			Influent			Effluent		
	# Samples	# Detections	Average (mg/L)	# Samples	# Detections	Average (mg/L)	# Samples	# Detections	Average (mg/L)	# Samples	# Detections	Average (mg/L)
Metals												
Antimony	7	0	0	7	0	0	7	0	0	7	0	0
Chromium [3]	7	4	0.0039	7	0	0	7	2	0.0034	7	1	0.0029
Copper	7	7	0.089	7	7	0.017	7	7	0.061	7	7	0.0085
Cyanide (Total)	7	0	0	7	0	0	7	0	0	7	0	0
Lead	7	7	0.0045	7	1	0.00057	7	5	0.0023	7	4	0.0020
Mercury	7	6	0.00060	7	0	0	7	0	0	7	0	0
Selenium	7	2	0.00073	7	0	0	7	1	0.00080	7	0	0
Silver	7	5	0.0021	7	0	0	7	7	0.0043	7	0	0
Zinc	7	7	0.20	7	7	0.060	7	7	0.10	7	7	0.051
Volatile Organic Compounds												
Benzene	7	0	0	7	0	0	7	0	0	7	0	0
Semivolatile Organic Compounds												
BEHP	7	6	0.050	7	6	0.0074	7	7	0.073	7	0	0

Notes:

0 = Non-detected results were given the value of zero in the calculation of averages if the pollutant was not detected in any samples from a given source.

RLs for antimony, cyanide, and benzene were 0.001 mg/L, 0.0097 mg/L, and 0.001 mg/L, respectively

(1) Based on average of 7 sampling events in October 2003.

(2) Based on average of 7 sampling events in November 2003.

(3) Chromium concentrations are based on the average of 7 sampling events from January 2004 to July 2005.

4.0 DETERMINATION OF FLOWS AND LOADINGS

4.1 INTRODUCTION

The objective of the flow and loading evaluation was to determine the pollutant contributions from the domestic and NIND sectors, NHLW, Rio de Flag WRP sludge discharges, and from the industrial sector. This determination was the basis for developing allocations of allowable pollutant loadings and local limits to protect the Wildcat Hill WWTP and Rio de Flag WRP. The methodology was based on the 1987 and 2004 USEPA guidance manuals [6, 3] and previous local limits studies [1, 2].

Estimates of flows and loadings at the influent to each WWTP were needed to:

- Characterize domestic and other non-regulated loadings, which reduce the pollutant loading that can be allocated to industries.
- Predict relative growth of industrial and non-industrial wastewater sources, which affects the safety factor applied to allowable headworks loading.
- Establish the basis for allocation of allowable pollutant loadings among industries in flow-dependent allocation methods.

This chapter describes the methodology used to estimate and project the flows and calculate the loadings for 10 pollutants to the Wildcat Hill WWTP and Rio de Flag WRP: 9 POCs with "interim" local limits status and zinc with a "final" local limits status. Influent mass balances are also presented. The loadings calculation and influent mass balances for BOD_5 and TSS are presented in Chapter 7.

4.2 WASTEWATER FLOWS

Estimated and projected flows were calculated for background sources, industrial sources, and the influent at both WWTPs. These flows were used in the calculation of pollutant loadings.

4.2.1 Methodology

The flow contributions from the domestic and NIND sectors are not directly monitored, and have not been estimated separately in previous local limits studies. The use of methodologies for flow calculation based on population projection and per capita flow rates or on water/sewer account data facilitate the assessment of contributions from each of these sectors. For the purpose of this study, the use of the 2003 water consumption information and the wastewater records from other discharges to the Wildcat Hill WWTP and Rio de Flag WRP were considered for the flow distribution estimate.

The total wastewater flows produced within the Wildcat Hill WWTP and Rio de Flag WRP service areas were estimated based upon the following available information:

- Wildcat Hill WWTP influent: daily flow measurements for 2003 and 2004
- Rio de Flag WRP influent: daily flow measurements for 2003 and 2004
- Water consumption reports: monthly and annual average water consumption per customer class (i.e., commercial, residential, manufacturing), and top 100 commercial customers for 2003
- SIUs: 2004 monthly sewer usage records
- NHLW: seven flow measurements in October 2003
- Rio de Flag WRP sludge: seven flow measurements in November 2003

Although the flow records for these locations correspond to different time periods, the average flow for each location was assumed to represent annual average flow for the year 2003.

4.2.2 Flow Split

The Rio de Flag WRP operates as a skimming plant upstream of Wildcat Hill WWTP. According to information provided by Mr. Bill Case, City staff at the Rio de Flag WRP, currently approximately 20 percent of the wastewater flows produced in the Rio de Flag WRP service area (e.g., from domestic, NIND, and SIUs) is diverted to the Wildcat Hill WWTP service area. In February 2003, the Rio de Flag WRP received all the wastewater flow produced upstream of the plant and no flow was passed on to Wildcat Hill WWTP service area. Dry weather flows measured at the influent of Rio de Flag WRP ranged between 2.5 and 2.7 mgd. Since the City typically operated Rio de Flag WRP at 2 mgd, 80 percent of the Rio de Flag WRP service area is then estimated to be treated at the Rio de Flag WRP and 20 percent is diverted to Wildcat Hill WWTP for treatment.

Mr. Paul Raczkowski, City Utilities Senior Project Manager, indicated that starting January 2006 SCA Tissue North America (SCA) is discharging its effluent to the Rio de Flag WRP instead of the Wildcat Hill WWTP. The effluent continues to flow over the SCA plant secondary clarifier weir to a newly installed tank, and then is pumped to the gravity sewer on Butler Avenue that connects to the main interceptor in the Rio de Flag wash. Consistent with the flow split used to calculate the current and projected flows, 80 percent of the projected SCA flows are treated at Rio de Flag WRP and the remaining 20 percent are treated at Wildcat Hill WWTP.

In addition, the City is planning to increase the wastewater flows to Rio de Flag WRP from approximately 2 mgd to approximately 3 mgd by mid-2007. The goal of the flow diversion is to create more A+ reuse water at Rio de Flag WRP. At this point, the City's

wastewater flow split between the two plants after the planned improvements at Wildcat Hill WWTP and Rio de Flag WRP are completed is unknown. Therefore, the current assumptions for calculating the flow contributions to each plant, including the 80/20 wastewater flow split in the Rio de Flag WRP service area were used for the flow projections, MAHL calculation, and limits determination.

4.2.3 Wastewater Production

Based on the configuration of the sewer collection system and the location of SIUs, the wastewater production for the Wildcat Hill WWTP service area and Rio de Flag WRP service area is described by the following equations:

For Wildcat Hill WWTP

$$Q_w \text{ produced} = Q_w \text{ treated in WCH} - Q_w \text{ diverted from RDF}$$
$$= Q_w \text{ treated in WCH} - 20\% \; Q_w \text{ produced in RDF}$$

For Rio de Flag WRP

$$Q_w \text{ produced} = Q_w \text{ treated at RDF} + Q_w \text{ diverted to WCH}$$
$$= Q_w \text{ treated at RDF} / 80\%$$

where: Q_w = Wastewater flow
WCH = Wildcat Hill WWTP service area
RDF = Rio de Flag WRP service area

Table 4.1 presents the wastewater produced within the Wildcat Hill WWTP and the Rio de Flag WRP service areas as a result of the flow split.

Table 4.1 – Wastewater Flows within Service Areas (mgd)

Service Area	Treated at WWTP or WRP	Diverted to / from	Total Produced
Wildcat Hill WWTP	3.88	0.496	3.38
Rio de Flag WRP	1.99	0.496	2.49
Total	5.87		5.87

Table 4.2 presents the summary of the 2003 average flows for the SIUs and the flows that are discharged to the Wildcat Hill WWTP and the Rio de Flag WRP as a result of the flow split. The subtraction of the SIU, NHLW, and Rio de Flag WRP sludge from the total wastewater produced within each service area resulted in the estimation of the remaining background flows discharged by the domestic and NIND sectors and the preliminary flow distribution by sectors, as presented in Table 4.3.

Table 4.3 - Preliminary Distribution of Wastewater Production by Sector (mgd)				
Wastewater	**Wildcat Hill WWTP**	**% Sector / Total Wildcat Hill WWTP**	**Rio de Flag WRP**	**% Sector / Total Rio de Flag WRP**
Total	3.38		2.49	
SIUs	0.320	9.5%	0.484	16.6%
NHLW	0.0037	0.1%	0	0%
Rio de Flag WRP Sludge	0.074	2.2%	0	0%
Remaining flows from domestic and NIND sectors	2.98	88.2%	2.00	84.4%

The results of the preliminary flow distribution indicate that a total of 4.98 mgd are produced by the domestic and NIND sectors combined, which represent approximately 85 percent of the total flows of 5.87 mgd produced within the Wildcat Hill WWTP and Rio de Flag WRP service areas.

4.2.4 Detailed Wastewater Distribution

The wastewater distribution for the domestic and NIND sectors on a service area basis was determined using the City's monthly and annual water consumption flows [3]. The evaluation and results are summarized in the following steps:

1. Assess water consumption per customer class on City-wide basis to determine relative percentage between domestic and commercial classes without the influence of irrigation by evaluating usage during winter months. Winter months are consistent with some utilities' billing practices for wastewater usage determination. Adjust the annual domestic and commercial water consumption volumes by these percentages.
2. Adjust the City-wide commercial class water consumption flow to remove any customers that are regulated as SIUs.
3. Calculate the percentage of water consumption corresponding to the domestic and commercial classes and apply to the wastewater production on City-wide basis to estimate the domestic and NIND sectors distribution.
4. Separate the adjusted commercial class customers into their respective service area based on geographical location to estimate percent of NIND wastewater production in each service area.
5. Apply service area percentages to the NIND wastewater flow to determine the domestic and NIND sector flows at each plant.

Step 1:

The water consumption information per customer class facilitated the estimation of the detailed wastewater distribution for the domestic and NIND sectors on a city-wide and

service area basis. The annual average water consumption report focused on a total of 18,842 customers/meters grouped in the following classes:

- Commercial
- Manufacturing
- NAU
- Residential single family
- Residential multi-family
- Residential multi-meter
- Lawn meters (commercial)
- Lawn / landscaping meters
- Lawn meter (manufacturing)
- Standpipe

Some commercial and manufacturing facilities, possibly the larger ones in size, have multiple meters, separating the water used for landscaping and irrigation from other water uses. The lawn and landscaping meters for commercial and manufacturing facilities have no correlation to wastewater production and were not included for the estimation of the detailed wastewater distribution. On the contrary, the meters for the residential classes account for all the water uses, including irrigation. In order to assess the effect of the amount of irrigation water on the residential classes' water consumption the monthly water consumption data were reviewed. The 2003 monthly consumption rates for the residential and commercial accounts are presented in Table 4.4.

The monthly water consumption rates for the residential and commercial classes follow a similar trend, with higher water consumption during the summer months (peak in July) and lower consumption during the winter months (February to April). The percent water consumption per class (water consumption of each class divided by total water consumption) varies from 66.2% to 71.7% and from 28.3% to 33.8% for the total residential and commercial classes, respectively, depending on the monthly consumption during the year. The lower the monthly consumption, the lower the percent water consumption for the total residential class, and vice versa. This suggests the following:

- During the summer months (e.g., July) the total residential class water consumption increases possibly due to the greater proportion of water used for landscape irrigation than the proportion of irrigation water that the commercial class uses during the same month.
- During the winter months (e.g., February to April), the water consumption for the total residential and commercial classes decreases because less water is necessary

for landscaping irrigation. The percent water consumption for these months may be the most representative water consumption distribution without the influence of irrigation water consumption.

In order to adjust the water consumption for the total residential class and account for similar proportion of irrigation water to the commercial class, the percent water consumption for the winter months of 67% for the total residential class and 33% for the commercial sector will be used. The total residential water consumption without the relative influence of irrigation was then estimated by multiplying the total annual residential and commercial consumption rate of 5.72 mgd (from Table 4.4) by 67% /100, resulting in 3.83 mgd. The adjusted commercial class water consumption was estimated as 1.89 mgd. These values were used for the water consumption distribution.

Step 2:

The individual water consumption information for the top 100 commercial customers, manufacturing facilities, and NAU were also reviewed. Some facilities identified as SIUs were classified as commercial business or as manufacturing. Also, some facilities that are not SIUs were classified as manufacturers. The total water consumption for the commercial class (e.g., 1.89 mgd from Table 4.4) and for the SIUs were adjusted. The following table compiles the estimated total water consumption for the customer classes grouped as domestic sector (including the single family and multifamily residential), NIND sector (including the commercial), and SIUs.

Table 4.5 - Water Consumption Distribution by Sector (mgd)

Sectors	Water Consumption Rate	% Water Consumption / Total Background	% Water Consumption / Total
Domestic	3.83	68.3%	58.1%
NIND	1.78	31.7%	26.9%
Sum Domestic and NIND	5.61	100.0%	85.0%
SIUs	0.905	-	13.7%
Total	6.60	-	100.0%

The water consumption distribution is consistent with the wastewater production distribution, with the combined domestic and NIND water consumption of approximately 85 percent (58.1 + 26.9) of the total water consumption.

Step 3:

By applying the water consumption percent distributions for the domestic sector (i.e., 68.3 percent) and NIND sector (i.e., 31.7 percent) to the combined domestic and NIND wastewater production of 4.98 mgd, the wastewater production rates for the domestic and NIND sectors were estimated to be 3.40 mgd and 1.58 mgd, respectively.

Step 4:

In order to estimate the flow distribution for the domestic and NIND sectors on a service area basis, the water consumption information for 121 commercial customers was reviewed. The water consumption for these businesses ranged from 30 gallons per day (gpd) to 88,178 gpd and represented a total of 59 percent of the total water consumption for the commercial customers. Based on the geographical location of these 121 businesses it was determined that 62.2 percent of the water consumption and by correlation the wastewater production occurs within the Rio de Flag WRP service. The remaining 37.8 percent of the commercial water consumption is allocated to the Wildcat Hill WWTP service area.

Step 5:

By applying these service area percentages to the estimated wastewater production for the NIND sector, the estimated wastewater flows were determined for each service area, as presented in the following table.

Table 4.6 – Detailed Wastewater Production by Sector (mgd)

Service Area / Sectors	Total Produced	Diverted to / from	Total Treated	% Sector / Total Treated
Wildcat Hill WWTP				
Domestic	2.39	+0.204	2.59	66.8%
NIND	0.596	+0.197	0.793	20.4%
NHLW	0.0037	0	0.0037	0.1%
Rio de Flag WRP Sludge	0.074	0	0.07	1.9%
SIUs	0.320	+0.096	0.416	10.7%
Total	3.38	+0.496	3.88	
Rio de Flag WRP				
Domestic	1.02	-0.204	0.814	40.9%
NIND	0.98	-0.197	0.786	39.5%
SIUs	0.484	-0.096	0.389	19.5%
Total	2.49	-0.496	1.99	

The domestic sector contributes with the majority of wastewater flows to each service area, with a significant fraction of 67 percent to the Wildcat Hill WWTP. Both the domestic and NIND sectors contribute similar fractions to the Rio de Flag WWTP, with 41 percent and 40 percent, respectively. The industrial contributions to each service area are comparable, representing 11 percent of the total flows for the Wildcat Hill WWTP and 20 percent of the Rio de Flag WRP flows.

4.2.5 Wastewater Projected Flows

Similar to the 2002 Study [1], the flow projections were performed by assuming a 3.2 percent annual growth rate, based on the Flagstaff 2020 Community Visioning Project [7] and adjusting the SCA flows due to the flow diversion. The 2003 and 2009 flows are presented in Table 4.7.

Table 4.7 - Summary of 2003 and Projected Flows

Sectors	Flows (mgd)		% Sector / Total	
	2003	2009	2003	2009
Wildcat Hill WWTP				
Domestic Sector	2.59	3.13	67%	70%
NIND Sector	0.79	0.96	20%	22%
NHLW	0.0037	0.0044	0%	0%
Rio de Flag Sludge	0.074	0.090	2%	2%
SIUs	0.42	0.26	11%	6%
Total	3.88	4.44	100%	100%
Rio de Flag WRP				
Domestic Sector	0.81	0.98	41%	37%
NIND Sector	0.79	0.95	39%	36%
SIUs	0.39	0.712	20%	27%
Total	1.99	2.65	99%	100%

As a result of the diversion of the SCA flows to the Rio de Flag WRP service area, the projected industrial flows to the Rio de Flag WRP increased from 0.39 mgd to 0.71 mgd. On the other hand, as the projected industrial flows to Wildcat Hill WWTP decreased and the domestic and NIND flow contributions increased from 67 percent to 70 percent and to 20 percent to 22 percent, respectively. This will have an impact on the background loading projections and local limits calculation, which is discussed in Chapter 6.

The observed 2003 wastewater flows for Wildcat Hill WWTP and Rio de Flag WRP totaled 5.87 mgd. The projected 2004 wastewater flows for Wildcat Hill WWTP and Rio de Flag WRP, calculated in the 2002 study, totaled 6.94 mgd (e.g., 4.82 mgd for Wildcat Hill WWTP and 2.12 mgd for Rio de Flag WRP), which is considerably higher than the observed 2003 flows. In addition, the projected 2004 flows of 6.94 mgd are only slightly lower than the projected 2009 flow projections of 7.09 mgd (e.g., 4.44 mgd plus 2.65 mgd) . These possible overestimations were discussed with Mr. Paul Raczkowski and may be influenced by the following:

- There has been a slight decrease in water consumption and wastewater production in recent years possibly due to water conservation measures (i.e., promotion of installation of low flow fixtures in old and new homes).

- For approximately the last three years the City has been implementing measures to minimize water infiltration to the collection system and to measure accurately for the influent and internal flows (i.e., filter backwash recycling) at the Wildcat Hill WWTP and Rio de Flag WRP. It was found that, for example, approximately 1 mgd from internal flows recycled to the headworks of the Wildcat Hill WWTP prior to the influent flow meter had been accounted as a part of the influent flows.

In addition, the population estimates are consistent with the projections, which suggests that the City is growing as expected. Therefore, the use of the 3.2 percent annual growth rate for the flow projections represents a feasible and conservative approach that is consistent with the methodology used in the 2002 study.

4.3 WASTEWATER LOADINGS

The following sections describe the calculation of the loadings for each sector discharging to both treatment plants. These calculations were conducted using the 2003 annual flows and the average concentrations for each POC.

4.3.1 Background Loadings

The background loadings were calculated by summing the loadings from the domestic sector, NIND sector, NHLW, and Rio de Flag WRP sludge. The 2003 pollutant loadings for each background location were calculated by multiplying the average concentrations for each POC by the corresponding average flows. Table 4.8 and 4.9 present the loading calculations for the background sources discharging to the Wildcat Hill WWTP and the Rio de Flag WRP.

4.3.2 SIU Loadings

The 2003 pollutant loadings for the SIUs were calculated by multiplying the average concentrations for each POC by the corresponding average flows. Tables 4.10 and 4.11 present the loading calculation for the SIUs discharging to the Wildcat Hill WWTP and the Rio de Flag WRP.

4.3.3 Influent Loadings

The 2003 pollutant loadings for the influent of the Wildcat Hill WWTP and the Rio de Flag WRP were calculated by multiplying the average concentrations for each POC by the corresponding average influent flows, as presented in Table 4.12.

4.4 INFLUENT MASS BALANCES

For each plant, the sum of the background and industrial loadings was compared to the observed influent loading to determine if the pollutant loadings from individual sources have been identified.

4.4.1 Influent Mass Balance Results

Table 4.13 present the results of the influent mass balances at the Wildcat Hill WWTP and the Rio de Flag WRP. In general, a closure of 80% to 120% is desirable (i.e., the calculated service area loading should be within +/- 20% of the observed influent loading). The results of the mass balances are as follows:

Wildcat Hill WWTP

- Reasonable mass balance closures (80-120%) were obtained for copper (92%), zinc (82%), and BEHP (91%).
- Calculated loadings were less than the plant's estimated influent loadings for lead (55%), mercury (15%), and silver (78%).
- Calculated loadings were greater than the plant's observed influent loadings for selenium (154%).
- Antimony and total cyanide were not detected at the influent of Wildcat Hill WWTP, but were measured at other locations within the sewer system (e.g., manholes, SIUs). Half the RL for each pollutant was used to estimate the average influent concentration and then compare to the sum of the background and industrial loadings. Background and industrial loadings were less than the plant's estimated influent loadings for antimony (21%) and total cyanide (15%). This shows the difficulty of calculating accurate mass balances when the pollutant levels are very close or below the RLs.

Rio de Flag WRP

- Reasonable mass balance closures (80-120%) were obtained for lead (110%), silver (101%), and BEHP (85%).
- Calculated loadings were greater than the plant's observed influent loadings for copper (130%), mercury (145%), selenium (130%), and zinc (136%). The use of the RL for mercury as influent concentration resulted in underestimation of the influent loading. The high percentage for copper and zinc indicate an overestimate of the background sources and/or and overestimate of the SIU contributions.
- Total cyanide was not detected at the influent of Rio de Flag WRP, but was measured at other locations within the sewer system (e.g., manholes, SIUs). Half the RL was used to estimate the average influent concentration and then compare to the sum of the background and industrial loadings. Background and industrial loadings were less than the plant's estimated influent loadings for total cyanide (11%). This shows the difficulty of calculating accurate mass balances when the pollutant levels are very close or below the RLs.
- Antimony was not detected at the Rio de Flag WRP influent, in the domestic and NIND sampling locations or at SIUs that discharge to the Rio de Flag WRP; therefore, the influent mass balance could not be performed.

The use of site-specific data (e.g., from local sampling events), rather than literature values, resulted in better influent mass balance closures than were calculated in the previous study. In the previous study only two POCs had mass balance closures between 80 and 120%. For most POCs, domestic and NIND sources make up the highest proportion of the influent loading to the treatment plants. Therefore, the use of accurate domestic and NIND concentrations and representative flow contributions are necessary to arrive at reasonable mass balance closures.

Influent Mass Balances for Zinc

In accordance with the recommendations of the 2002 local limits study, zinc was one of the metals with "final" status that required performing the influent mass balances. The zinc mass balance closures based on the 2003 sampling data were different from the mass balances in the 2002 study:

- For Wildcat Hill WWTP, the closure improved from 42% to 82%.
- For Rio de Flag WRP, the closure increased from 71% to 136%.

The changes in the mass balance closures may be a result of increasing the number of sampling locations (i.e., from one manhole location to three) and estimation of separate flow contributions for the domestic and NIND sector, which provides a better characterization of the background loadings.

Table 4.2 - 2003 SIU Flows (gpd)						
Industry	**Daily Average**	**Current Service Area**	**Average Flow Produced in WCH**	**Average Flow Produced in RDF**	**Average Flow Treated at Wildcat Hill WWTP**	**Average Flow Treated at Rio de Flag WRP**
SCA Tissue	250,700	WCH	250,700	0	250,700	0
Northern Arizona University - Dome (Sinclair Wash) [1]	316,960	RDF	0	316,960	63,392	253,568
Northern Arizona University - Biology (Wettaw) [1]	60,960	RDF	0	60,960	12,192	48,768
Northern Arizona University - Chemistry	0	RDF	0	0	0	0
Northern Arizona University - Biochemistry (Beaver/Ellery) [1]	5,580	RDF	0	5,580	1,116	4,464
Flagstaff Medical Center	56,800	RDF	0	56,800	11,360	45,440
Mission Linen & Uniform (Huntington Drive)	26,400	WCH	26,400	0	26,400	0
Nestle Purina	20,700	WCH	20,700	0	20,700	0
Pepsi Cola Bottling Company	11,600	WCH	11,600	0	11,600	0
Joy Cone	5,800	RDF	0	5,800	0	5,800
W.L. Gore - Woody Mountain	30,424	RDF	0	30,424	6,085	24,339
W.L. Gore - Echo Ridge	7,900	RDF	0	7,900	1,580	6,320
W.L. Gore - 4th Street	10,800	WCH	10,800	0	10,800	0
Total	**804,624**		**320,200**	**484,424**	**415,925**	**388,699**

Notes:

(1) Total current average flowrate for Northern Arizona University is 383,500 gpd. This flowrate was divided among the three SIUs proportionally based on the flowrates used in the previous report.

WCH = Wildcat Hill WWTP service area

RDF = Rio de Flag WRP service area

Table 4.8 - 2003 Background Loading Calculation for Wildcat Hill WWTP										
Sources	**Domestic**		**NIND**		**NHLW**		**Rio de Flag WRP**		**Total Background**	
2003 Flows (gpd)	**2,591,804**		**792,763**		**3,650**		**74,300**		**3,462,516**	
Pollutant	**Conc. (mg/L)**	**Loading (lb/day)**	**Conc. (mg/L)**	**Loading (lb/day)**	**Conc. (mg/L)**	**Loading (lb/day)**	**Conc. (mg/L)**	**Loading (lb/day)**	**Conc. (mg/L)**	**Loading (lb/day)**
Metals										
Antimony	0	0	0	0	0.010	0.00031	0	0	0.000011	0.00031
Copper	0.069	1.5	0.083	0.5	2.9	0.088	0.48	0.30	0.084	2.4
Cyanide (Total)	0	0	0	0	0.0075	0.00023	0	0	0.000008	0.00023
Lead	0.0013	0.029	0.0020	0.013	0.099	0.0030	0.024	0.015	0.0021	0.060
Mercury	0.000062	0.0013	0	0	0.012	0.00037	0.00097	0.00060	0.00008	0.0023
Selenium	0.0012	0.026	0.0014	0.009	0.028	0.00084	0	0	0.0012	0.036
Silver	0	0	0	0	0.0061	0.00019	0.056	0.035	0.0012	0.035
Zinc	0.14	2.9	0.16	1.0	12	0.37	0.70	0.44	0.16	4.8
Volatile Organic Compounds										
Benzene	0.00031	0.0068	0	0	0.0033	0.00010	0	0	0.00024	0.0069
Semivolatile Organic Compounds										
BEHP	0.023	0.50	0.121	0.80	0.180	0.0055	0.019	0.012	0.045	1.31

Notes:
NHLW = Non-Hazardous Liquid Waste
NIND = Non-industrial / non-domestic
NA = Not Analyzed

Table 4.9 - 2003 Background Loading Calculation for Rio de Flag WRP						
Sources	**Domestic**		**NIND**		**Total Background**	
2003 Flows (gpd)	**814,352**		**786,088**		**1,600,440**	
Pollutant	**Conc. (mg/L)**	**Loading (lb/day)**	**Conc. (mg/L)**	**Loading (lb/day)**	**Conc. (mg/L)**	**Loading (lb/day)**
Metals						
Antimony	0	0	0	0	0	0
Copper	0.069	0.47	0.083	0.54	0.076	1.01
Cyanide (Total)	0	0	0	0	0	0
Lead	0.0013	0.009	0.0020	0.013	0.0017	0.022
Mercury	0.000062	0.00042	0	0	0.000031	0.00042
Selenium	0.0012	0.008	0.0014	0.009	0.0013	0.017
Silver	0	0	0	0	0	0
Zinc	0.14	0.9	0.16	1.0	0.15	1.9
Volatile Organic Compounds						
Benzene	0.00031	0.0021	0	0	0.00016	0.0021
Semivolatile Organic Compounds						
BEHP	0.023	0.16	0.12	0.79	0.071	0.95

Notes:
NHLW = Non-Hazardous Liquid Waste
NIND = Non-industrial / non-domestic
NA = Not Analyzed

Table 4.10 - SIU Loading Calculation for Wildcat Hill WWTP

SIUs	NAU - Dome		NAU - Biology		NAU - Biochemistry		Flagstaff Medical Center		W.L. Gore - Woody Mountain		W.L. Gore - Echo Ridge		Joy Cone		SCA Tissue		Mission Linen & Uniform (Huntington Dr.)		Nestle Purina		Pepsi Cola Bottling Company		W.L. Gore - 4th Street		SIU Loading (Total WCH Service Area)	
2003 Flows (gpd)	63,392		12,192		1,116		11,360		6,085		1,580		0		250,700		26,400		20,700		11,600		10,800		415,925	
Pollutant	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)
Metals																										
Antimony	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.012	0.0026	0.0027	0.0005	0	0	0	0	0.0009	0.0031
Chromium	0	0	0	0	0	0	0	0	0	0	0	0	0.056	0	0.0040	0.008	0.017	0.0037	0.024	0.0041	0.0083	0.0008	0.016	0.0014	0.0053	0.018
Cyanide (Total)	0	0	0.012	0.0012	0	0	0.0087	0.0008	0	0	0	0	0.014	0	0.0093	0.019	0	0	0.0079	0.0014	0	0	0	0	0.00659	0.023
Copper	0.062	0.033	0.24	0.024	0.064	0.00060	0.099	0.0094	0.11	0.0056	0.063	0.00082	0.066	0	0.012	0.025	0.32	0.071	0.17	0.0296	0.077	0.0074	0.040	0.0036	0.061	0.21
Lead	0.0061	0.0032	0.0041	0.0004	0.0087	0.00008	0.0013	0.00012	0.017	0.00086	0	0	0.0069	0	0	0	0.050	0.011	0.018	0.0031	0.0054	0.0005	0	0	0.00559	0.019
Mercury	0.0004	0.00023	0.0025	0.00025	0	0	0	0	0.0003	0.00001	0	0	0	0	0	0	0.00014	0.00003	0.00073	0.0001	0	0	0	0	0.00019	0.00065
Selenium	0	0	0	0	0.0013	0.00001	0	0	0	0	0	0	0	0	0	0	0	0	0.0012	0.0002	0.0014	0.00013	0	0	0.00010	0.00035
Silver	0.012	0.0061	0.012	0.0012	1.1	0.010	0.0074	0.00070	0	0	0	0	0	0	0	0	0.0017	0.00038	0	0	0	0	0	0	0.00529	0.018
Zinc	0.14	0.075	0.054	0.0055	0.15	0.0014	0.089	0.0084	0.17	0.0088	0.035	0.00046	0.16	0	0.035	0.07	0.61	0.13	0.75	0.13	0.34	0.032	0.11	0.010	0.14	0.48
Volatile Organic Compounds																										
Benzene	0	0	0	0	0	0	0	0	0	0	0	0	0.011	0	0	0	0	0	0.0018	0	0	0	0	0	9E-05	0.00031
Semivolatile Organic Compounds																										
BEHP	0.023	0.012	0.014	0.0014	0.034	0.00032	0.058	0.0055	0.028	0.0014	0.009	0.00012	0	0	0	0	0.45	0	0.20	0	0.038	0	0	0	0.045	0.158

NAU = Northern Arizona University

Table 4.11 - SIU Loading Calculation for Rio de Flag WRP

SIUs	NAU - Dome		NAU - Biology		NAU - Biochemistry		Flagstaff Medical Center		W.L. Gore - Woody Mountain		W.L. Gore - Echo Ridge		Joy Cone		SCA Tissue		Mission Linen & Uniform (Huntington Dr.)		Nestle Purina		Pepsi Cola Bottling Company		W.L. Gore - 4th Street		SIU Loading (Total RDF Service Area)	
2003 Flows (gpd)	253,568		48,768		4,464		45,440		24,339		6,320		5,800		0		0		0		0		0		388,699	
Pollutant	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)
Metals																										
Antimony	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.012	0	0.0027	0	0	0	0	0	0	0
Chromium	0	0	0	0	0	0	0	0	0	0	0	0	0.056	0.0027	0.0040	0	0.017	0	0.024	0	0.0083	0	0.016	0	0.00084	0.003
Cyanide (Total)	0	0	0.012	0.0049	0	0	0.0087	0.0033	0	0	0	0	0.014	0.0007	0.0093	0	0	0	0.0079	0	0	0	0	0	0.00273	0.009
Copper	0.062	0.131	0.24	0.097	0.064	0.00238	0.099	0.0375	0.11	0.0223	0.063	0.00329	0.066	0.0032	0.012	0	0.32	0	0.17	0	0.077	0	0.040	0	0.092	0.30
Lead	0.0061	0.0129	0.0041	0.0017	0.0087	0.00032	0.0013	0.00048	0.017	0.00345	0	0	0.0069	0.0003	0	0	0.050	0	0.018	0	0.0054	0	0	0	0.00591	0.019
Mercury	0.0004	0.00093	0.0025	0.00100	0	0	0	0	0.0003	0.00006	0	0	0	0	0	0	0.00014	0	0.00073	0	0	0	0	0	0.00061	0.00199
Selenium	0	0	0	0	0.0013	0.00005	0	0	0	0	0	0	0	0	0	0	0	0	0.0012	0	0.0014	0	0	0	0.00001	0.00005
Silver	0.012	0.0245	0.012	0.0047	1.1	0.040	0.0074	0.00280	0	0	0	0	0	0	0	0	0.0017	0	0	0	0	0	0	0	0.02218	0.072
Zinc	0.14	0.300	0.054	0.0220	0.15	0.0057	0.089	0.0337	0.17	0.0352	0.035	0.00184	0.16	0.0077	0.035	0	0.61	0	0.75	0	0.34	0	0.11	0	0.13	0.41
Volatile Organic Compounds																										
Benzene	0	0	0	0	0	0	0	0	0	0	0	0	0.011	0.0005	0	0	0	0	0.0018	0	0	0	0	0	0.00016	0.00053
Semivolatile Organic Compounds																										
BEHP	0.023	0.049	0.014	0.0058	0.034	0.00127	0.058	0.0218	0.028	0.0056	0.009	0.00047	0	0	0	0	0.45	0	0.20	0	0.038	0	0	0	0.026	0.084

NAU = Northern Arizona University

Table 4.12 - 2003 Influent Pollutant Loadings for Wildcat Hill WWTP and Rio de Flag WRP				
Sources	**Wildcat Hill WWTP**		**Rio de Flag WRP**	
2003 Flows (gpd)	3,878,441		1,989,140	
Pollutant	**Concentration (mg/L)**	**Loading (lb/day)**	**Concentration (mg/L)**	**Loading (lb/day)**
Metals				
Antimony [1]	0.0005	0.016	0	0
Chromium	0.0039	0.13	0.0034	0.056
Copper	0.089	2.9	0.061	1.0
Cyanide (Total) [2]	0.0049	0.16	0.0049	0.080
Lead	0.0045	0.14	0.0023	0.038
Mercury [3]	0.00060	0.019	0.00010	0.0017
Selenium	0.00073	0.024	0.00080	0.013
Silver	0.0021	0.069	0.0043	0.071
Zinc	0.20	6.4	0.10	1.7
Volatile Organic Compounds				
Benzene [2]	0.00050	0.016	0.00050	0.0083
Semivolatile Organic Compounds				
BEHP	0.050	1.6	0.073	1.2

Notes:

(1) Antimony was detected in the collection system and not at the influent of Wildcat Hill WWTP.

Half of the reporting limit was used as the average concentration instead of zero.

(2) Total cyanide and benzene were detected in the collection system and not at the influent of the Rio de Flag WRP and Wildcat Hill WWTP.

Half of the reporting limit was used as the average concentration instead of zero.

(3) Mercury was detected in the collection system and not at the influent of Rio de Flag WRP.

Half of the reporting limit was used as the average concentration instead of zero.

Table 4.13 - Influent Mass Balance for Wildcat Hill WWTP and Rio de Flag WRP										
Pollutants	**Wildcat Hill WWTP - Loadings (lb/day)**					**Rio de Flag WRP - Loadings (lb/day)**				
	Total Background	**SIUs**	**Total**	**WWTP Influent**	**% Closure**	**Total Background**	**SIUs**	**Total**	**WRP Influent**	**% Closure**
Metals										
Antimony	0.00031	0.0031	0.0034	0.016	21%	0	0	0	0	-
Copper	2.4	0.21	2.63	2.87	92%	1.0	0.30	1.3	1.01	130%
Cyanide (Total)	0.00023	0.023	0.023	0.16	15%	0	0.0089	0.0089	0.080	11%
Lead	0.060	0.019	0.080	0.14	55%	0.022	0.019	0.041	0.038	110%
Mercury	0.0023	0.00065	0.0030	0.019	15%	0.00042	0.0020	0.0024	0.0017	145%
Selenium	0.036	0.00035	0.036	0.024	154%	0.017	0.000047	0.017	0.013	130%
Silver	0.035	0.018	0.053	0.069	78%	0	0.072	0.072	0.071	101%
Zinc	4.8	0.479	5.2	6.4	82%	1.9	0.41	2.4	1.7	136%
Volatile Organic Compounds										
Benzene	0.0069	0.00031	0.0072	0.016	45%	0.0021	0.00053	0.0027	0.0083	32%
Semivolatile Organic Compounds										
BEHP	1.31	0.16	1.5	1.6	91%	0.95	0.084	1.03	1.2	85%
Others										
BOD_5	14,656	1,130	15,786	13,636	116%	9,090	1,233	10,323	4,316	239%
TSS	9,404	1,151	10,555	13,294	79%	4,099	441	4,539	3,965	114%

5.0 DEVELOPMENT OF ALLOWABLE HEADWORKS LOADINGS

5.1 GENERAL

The allowable headworks loading (AHL) calculations were performed to determine the mass loading which can be received at the headworks and not create pass-through or interference problems at the Wildcat Hill WWTP and Rio de Flag WRP. The AHL method is a technically based approach to development of local limits which includes the following steps:

- Review and compile the applicable criteria to protect the end uses of effluent and biosolids and of the inhibition thresholds to protect biological processes at the WWTPs.
- Select overall and primary removal efficiencies (REs) through review of site-specific sampling results and of historical and literature values.
- Use WWTP influent flows and biosolids production projections for the year 2009 for each plant.
- Calculate AHL based on the applicable criteria.
- Determine maximum allowable headworks loading (MAHL).

Three scenarios were considered for the MAHL determination, consisting of the current biological processes at both plants based on site-specific data and also an estimate of the future conditions at Wildcat Hill WWTP once the conversion to activated sludge processes is operational by mid-2007. The removal efficiencies selected for Rio de Flag WRP were used to model the future scenario of Wildcat Hill with activated sludge processes. The MAHL determination for this additional scenario at Wildcat Hill WWTP was used only for comparison purposes and to formulate action plans complementing the implementation of local limits, but not for the calculation of proposed limits.

The following sections present the results of this analysis for the ten pollutants suitable for the AHL method, as recommended in the 2002 Flagstaff Local Limits Study [1]:

- Nine pollutants with "interim" local limits status: antimony, copper, cyanide, lead, mercury, selenium, silver, benzene, and BEHP
- One conservative pollutants with "final" local limits status: chromium

5.2 PASS-THROUGH CONSIDERATIONS

Pass-through considerations are assessed through application of water quality criteria. For the AHL determination at the Wildcat Hill WWTP and Rio de Flag WRP, the most stringent effluent criteria were identified, as presented in Table 5.1. Effluent criteria were

based on the most stringent of the AZPDES, Aquifer Protection Permit (APP), Surface Water Quality Standards (SWQS), and Aquifer Water Quality Standards (AWQS).

5.3 INTERFERENCE CONSIDERATIONS

Interference considerations are assessed through application of sludge criteria and biological treatment process inhibition levels.

5.3.1 Sludge Criteria

The digested sludge produced at the Wildcat Hill WWTP is land injected at a dedicated site and is subject to federal and state criteria. The federal and state criteria are provided as pollutant concentration (ceiling and monthly average) and loading rate (annual and cumulative) limitations in 40 CFR Part 503, updated to September 2003. The most stringent biosolids criteria for the Wildcat Hill WWTP are also presented in Table 5.1.

5.3.2 Inhibition Thresholds

At the Wildcat Hill WWTP, existing biological processes include biotowers, trickling filters, and anaerobic digestion. The Rio de Flag WRP uses a nitrifying/denitrifying activated sludge process for biological treatment. Thus, inhibition levels for trickling filters, activated sludge, nitrification, and anaerobic digestion for individual pollutants were considered for the AHL analysis.

Information on inhibition levels is limited. When site specific inhibition levels are not available, the criteria used for this analysis for most pollutants were the available literature values from various sources, including the results of laboratory, pilot, and pure culture studies, as well as full-scale WWTP operating data.

Tricking filters, activated sludge and nitrification inhibition thresholds for certain pollutants were obtained from 1986 and 2004 USEPA Guidance Manuals [6, 3]. A review of the Water Environment Federation (WEF) Activated Sludge Manual of Practice OM-9 [8] and Biological and Chemical Systems for Nutrient Removal [9] revealed similar inhibition thresholds. Anaerobic digestion inhibition thresholds for certain pollutants were obtained from the USEPA guidance manuals [6, 3] and the WEF Manual of Practice No. 8 Design of Municipal Wastewater Treatment Plants [10]. The compilation of the inhibition thresholds for the Wildcat Hill WWTP and Rio de Flag WRP are presented in Table 5.2 and 5.3, respectively.

5.4 REMOVAL EFFICIENCIES

Site-specific removal efficiencies (REs) were calculated for 10 pollutants (conservative and non-conservative) to determine the percentages of the influent pollutant loading

removed across the primary treatment process and across the entire WWTP or WRP. Conservative pollutants (e.g., metals) are presumed not to be destroyed, biodegraded, chemically transformed, or volatilized within the WWTP or collection system. This assumption does not apply to non-conservative pollutants (e.g., organics).

5.4.1 Methodology

Wastewater concentration and flow data from the 2003 sampling event were used to calculate the overall REs. Site-specific REs were determined for pollutants with at least five pairs of data (i.e., influent and effluent data collected on the same sampling date), as recommended by the 2004 USEPA guidance manual [3]. If the pollutant was detected in the influent but not above the RL in the effluent, data substitution was performed according to the methodology presented in Section 3. Mass loadings for the influent and effluent were calculated by multiplying pollutant concentrations by the corresponding flows. These loadings were then used to determine the daily REs.

5.4.2 Loading Calculations

Using the pollutant data sets, the daily loadings at each location were calculated by multiplying the concentration in milligrams per liter (mg/L) by the corresponding flow in million gallons per day (mgd), as shown in the following equation:

$$L = Q \times C \times 8.34$$

Where:
L = Daily loading in lb/day
Q = Daily flow in mgd
C = Daily concentration in mg/L
8.34 = Unit conversion factor [(lb/million gallons) / (mg/L)]

5.4.3 Daily Removal Efficiency

The concept of daily REs, expressed as a percent, was applied by using the following equation:

$$\text{Daily RE} = \frac{(\text{Linf} - \text{Leff})}{\text{Linf}} \times 100$$

Where:
Linf = Influent loading in lb/day
Leff = Effluent loading in lb/day

The following two methods were considered for the calculation of the daily REs:

- Average Daily Removal Efficiency (ADRE): Calculate the daily RE for each paired data set (i.e., influent and effluent loadings from the same sampling date) and then average all the daily REs to determine the ADRE.

- Mean Removal Efficiency (MRE): Calculate the influent and effluent loadings for each day, average all the influent and effluent loadings separately, and then calculate the MRE by using the average loadings.

5.4.4 Statistical Data Evaluation

Reviews of data pairs and statistical evaluations were performed prior to the calculation of the site-specific REs. In addition, one statistical procedure, as described in the 2004 USEPA guidance manual [3], was applied to determine the presence of outliers.

The number of detected paired data sets and total paired data sets were determined to assess the quality of the analytical data and to assist in the selection of the REs for each POC at the Wildcat Hill WWTP and Rio de Flag WRP. The summaries of the available paired data sets are presented in Table 5.4.

Daily REs were calculated for each pollutant, and a formal statistical procedure was applied to determine the presence of outliers. The statistical procedure used included the following steps:

- Calculate influent and effluent loadings
- Calculate ADRE, MRE, and standard deviation
- If the ADRE set followed a normal distribution, consider any point that lies above or below two standard deviations from the mean an outlier
- Remove outliers and calculate final ADRE and MRE

Sample calculations of the ADREs, MREs, and outliers are presented in Appendix B.

5.4.5 Types of Removal Efficiencies

Once the outliers were identified and eliminated from the data pairs, overall removal efficiencies (OREs) and primary removal efficiencies (PRE) were determined. OREs are used to calculate the AHL on the basis of water quality pass-through, anaerobic digestion inhibition, and sludge interference. The following equations are used:

$$ORE = (Linf - Leff) / Linf \times 100$$

Where: Linf = Influent loading in lb/day
Leff = Effluent loading in lb/day

The OREs were calculated using the 2003 sampling data for the Wildcat Hill WWTP and Rio de Flag WRP. The summary of the calculated OREs is presented in Table 5.5.

Table 5.5 - Overall Removal Efficiencies based on 2003 Sampling		
Pollutant of Concern	**Wildcat Hill WWTP**	**Rio de Flag WRP**
Metals		
Antimony	-	-
Chromium	51	88
Copper	80	89
Cyanide (Total)	-	-
Lead	86	70
Mercury	84	-
Selenium	62	81
Silver	78	88
Volatile Organic Compounds		
Benzene	-	-
Semivolatile Organic Compounds		
BEHP	89	96

Note:
- = No removal efficiency was calculated. Sampling results from influent and effluent were either detected below the reporting limit or not detected.

PREs are used to calculate the AHL on the basis of secondary biological treatment inhibition to protect the activated sludge and nitrification processes. The following equations are used:

$$PRE = (Linf - Lpe) / Linf \times 100$$

Where: Linf = Influent loading in lb/day
Lpe = Primary effluent loading in lb/day

Primary effluent and primary sludge sampling results from the Wildcat Hill WWTP and Rio de Flag WRP were not available to calculate the site specific PREs. Historical or literature values were considered for the RE selection.

5.4.6 Historical and Literature Values

If a pollutant had less than five data sets of detected influent results or was never detected at the effluent of the plant, values from previous local limits studies and literature values were reviewed and considered for the RE selection, as presented in the Tables 5.6 and 5.7. The following sources were reviewed to supplement the site specific REs:

- Previous Studies: The REs from 1993 Flagstaff Local Limit Study [2] and 2002 local limit study [1] were compiled, summarized and compared to the calculated site-specific REs.

- USEPA Literature Values: The USEPA guidance manuals [6, 3] present REs for primary and activated sludge for conservative and non-conservative pollutants. These REs were summarized, and compared to the calculated-site specific REs.
- USEPA Database: The 1992 USEPA Risk Reduction Engineering Laboratory (RREL) Treatability Database Version 5.2 [11] was used to obtain ranges of REs for conservative and non-conservative pollutants. Results for full-scale facilities treating domestic wastewater were queried, and REs were compiled based on the pollutant's influent and effluent concentrations. REs for Wildcat Hill WWTP were based on the removal that occurs in trickling filters, while REs for Rio de Flag WRP were based on the removal that occurs in activated sludge treatment. The resulting REs were summarized and compared to the calculated site-specific REs, when available.

5.4.7 Removal Efficiency Selection

The selection of the REs was performed considering the site-specific REs calculated for the Wildcat Hill WWTP and Rio de Flag WRP and the values available from the previous studies and literature, as presented in Table 5.8. The removal efficiencies selected for Rio de Flag WRP are also selected for the Wildcat Hill WWTP with activated sludge processes scenario. In general, site-specific values calculated from current sampling events or from previous studies are preferred over literature values. When no RE was listed in the previous local limits studies, the USEPA guidance manuals were consulted. When no RE was listed in these guidance manuals, the median RE was obtained from the USEPA RREL database.

The removal of some pollutants changed at the Wildcat Hill WWTP and Rio de Flag WRP in comparison to the removals used in the 2002 local limits study [1]. The following summarize the major changes:

- At Wildcat Hill WWTP: The REs for copper, lead, and silver improved due to more recent sampling results. In addition, site-specific REs were selected for chromium and BEHP instead of the literature values used in the past.
- At Rio de Flag WRP: Site-specific REs were selected for chromium, copper, lead, silver, and BEHP as a result of available sampling results.

These observations confirm the importance of conducting periodic sampling at the plants and calculating site-specific removal efficiencies to characterize the plants' removal capacity for the pollutants.

Removal Efficiency for Total Chromium

In accordance with the recommendations of the 2002 local limits study, total chromium was one of the metals with "final" status that required calculating removal efficiencies.

The selected removal efficiencies for total chromium based on the 2004-2005 sampling data are comparable to the removal efficiencies used in the 2002 study:

- For Wildcat Hill WWTP, the selected removal efficiency was 51% while 55% (literature value) was used in the 2002 study.
- For Rio de Flag WRP, the selected removal efficiency was 88% while 82% (literature value) was used in the 2002 study.

Since the site specific values are similar to the literature values used in the 2002 study, the final recommendation of removing the local limit of 0.9 mg/L is confirmed.

5.5 WWTP MASS BALANCES

WWTP mass balances were performed for conservative pollutants to assess whether the selected REs accurately represent the removal mechanisms at the Wildcat Hill WWTP and Rio de Flag WRP. The ratio of the total mass in the sludge stream was compared to that removed in the wet stream. Under ideal conditions, the pollutant mass removed from the wet stream will equal the mass of the pollutant in the sludge streams, resulting in a total sludge to wet stream removal ratio of 100 percent. Calculated ratios within a range of 80 to 120 percent are desirable.

5.5.1 Methodology

Analytical and flow data from the 2003 sampling event were used to calculate the mass loadings for the wet and sludge streams at the plants. Detected analytical results and flows were compiled for the following locations:

- For Wildcat Hill WWTP: 7 sampling results for the influent and effluent, and 3 sampling results for the sludge to disposal
- For Rio de Flag WRP: 7 sampling results for the influent, effluent, and total sludge (primary sludge and waste activated sludge)

The daily loadings at each location were calculated by multiplying the pollutant concentration by the corresponding flow. Non-detected results were not used in this methodology. Based on the available data, two methods were used to estimate total sludge to wet stream removal ratio for conservative pollutants at the WWTPs:

- Average daily mass balance - The mean of daily ratios of the total sludge mass to the wet stream removal. This calculation, which uses paired data, shows daily variations in REs.
- Average mean mass balance - The ratio of the average daily total sludge mass to the average daily total wet stream mass removal. This calculation dampens daily variations in REs.

The average daily mass balance was based on paired data, while the mean mass balances also include unpaired data. Sample mass balance calculations are presented in the Appendix B.

5.5.2 Mass Balance Results

Based on the available detected data, mass balances were calculated only for copper at Wildcat Hill WWTP and copper, lead, and silver at Rio de Flag WRP. Table 5.9 present summaries of the mass balances for the Wildcat Hill WWTP and Rio de Flag WRP.

Table 5.9 - Mass Balance Results

Location	Pollutant of Concern	Average Daily	Average Mean
Wildcat Hill WWTP	Copper	6%	6%
Rio de Flag WRP	Copper	38%	36%
	Lead	18%	47%
	Silver	71%	53%

Accurate mass balances results for copper at Wildcat Hill WWTP were not accomplished because of the low number of detected sludge results (i.e., two sludge results). The sludge to disposal location was sampled at the same as time as the influent and effluent without the solids detention time taken into account. Accurate mass balances results for the lead and silver at Rio Flag WRP could not be calculated because of a low number of detected effluent results, although influent and sludge detected results were available. Mass balances for the other pollutants could not be performed because of a lack of detected values. This confirms the need for using supporting sources for REs.

5.6 ALLOWABLE HEADWORKS LOADINGS

The AHL calculations were conducted using wastewater flow and biosolids production projections for 2009; the selected removal efficiencies; and the criteria, standards, and inhibition thresholds applicable to the Wildcat Hill WWTP and Rio de Flag WRP.

5.6.1 Wastewater and Sludge Flows

The 2003 and 2004 daily wastewater flow and sludge production information were compiled from the daily operation records at Wildcat Hill WWTP and Rio de Flag WRP. These daily flow rates were used to calculate the annual average wastewater and sludge flows representative for the year 2003. The 2009 wastewater flow projections were used to perform the average sludge flow and sludge to disposal projection for the year 2009. Table 5.10 summarizes the wastewater and sludge projections used for the AHL calculations.

Table 5.10 – Wastewater and Sludge Flow Rates for AHL Calculations		
WWTP Parameters	**Year 2009**	
	Wildcat Hill WWTP	**Rio de Flag WRP**
Average influent flow (mgd)	4.443	2.64
Average sludge flow to digesters (mgd)	0.070	NA
Annual sludge to disposal production rate (dry tons/year)	4.12	NA

Notes:
NA = Not applicable

5.6.2 AHL Equations

The equations used to calculate the AHLs are listed in Appendix C and are based on the 2004 USEPA guidance manual [3]. These equations estimate the maximum pollutant loadings that the WWTP can receive at the headworks in order to protect the effluent, the biosolids process, and the WWTP biological processes from interference or upset problems.

5.6.3 AHL Results

The summary of the AHLs based on the effluent and sludge criteria and biological processes inhibition thresholds and the determination of the MAHLs for the Wildcat Hill WWTP and Rio de Flag WRP are presented in Tables 5.11, 5.12, and 5.13.

Since the last local limits study conducted in 2002, there have been changes to some of the environmental criteria and updated methodologies applied to the AHL calculations. These developments (summarized below) had an effect on the MAHL calculation on a pollutant-by pollutant basis:

- The current AZPDES permits included more stringent criteria for some pollutants in comparison to the permits used in 2002 local limits study [1]:
  - For the Wildcat Hill WWTP, the MAHL was based on the updated and in some cases more rigorous discharge limits for copper, cyanide, lead, mercury, selenium, and silver.
  - For the Rio de Flag WRP, the MAHL was based on the updated and in some cases more rigorous discharge limits for cyanide, lead, mercury, and selenium.
- The 2004 APP for Wildcat Hill WWTP and the 2002 APP for Rio de Flag WRP included more stringent criteria for some pollutants:
  - For the Wildcat Hill WWTP, the MAHL was based on the aquifer limits for benzene.
  - For the Rio de Flag WRP, the MAHL was based on the more rigorous aquifer limits for antimony and benzene.

The use of sampling data to calculate the site-specific REs for the pollutants also represented a change since the last local limits study. Tables 5.14 and 5.15 present the differences between the MAHLs calculated based on the current data and current conditions (e.g., trickling filters at Wildcat Hill WWTP) and the MAHLs from the 2002 local limits study. In general, lower MAHLs due to changes in the environmental criteria and/or removal efficiencies may represent more stringent limits than the limits calculated in the 2002 local limits study.

The calculation of the MAHL based on inhibition thresholds introduces the evaluation of the performance of the biological processes at the plants under certain pollutant concentrations and conditions. The MAHL for Rio de Flag WRP for silver is based on activated sludge inhibition threshold. Because the inhibition threshold is from the literature review, as opposed to site-specific inhibition studies, the next most stringent AHL, when available, is considered for the calculation of the local limits. In this case for silver at Rio de Flag WRP, the inhibition threshold is the only criterion available to calculate the MAHL.

5.6.4 Loading to MAHL Comparison

The 2004 USEPA guidance manual [3] recommends that an average influent loading to MAHL ratio of 60 percent or a maximum daily influent loading to MAHL ratio of 80 percent be used to establish the need for a local limit. The "influent loading-to-MAHL" ratio was calculated to assess the possibility of pollutant pass-through or interference problems at the WWTPs and to determine the need for local limits.

Wastewater flow and pollutant concentration data from the 2003 sampling event were used for the comparison. The average and daily influent loadings and MAHL for each pollutant at the Wildcat Hill WWTP (current conditions) and Rio de Flag WRP were compiled and are presented in Tables 5.16 and 5.17. The main findings of the comparison indicate that two pollutants at the Wildcat Hill WWTP exceeded the influent loading-to-MAHL criteria:

- The copper annual average and daily maximum influent loadings accounted for 89 percent and 211 percent of the MAHL, respectively.
- The BEHP annual average and daily maximum influent loadings accounted for 94 percent and 135 percent of the MAHL, respectively.

In addition, the background loading for copper and BEHP accounted for 75 percent and 66 percent of the MAHL at the Wildcat Hill WWTP, respectively. This indicates that background sources represent the largest fraction of the MAHL, reducing the loadings that can be allocated to SIUs.

The results of this comparison provide the level of risk for experiencing pass-through or interference for a specific pollutant at the Wildcat Hill WWTP and Rio de Flag WRP. These results provides the foundation for identifying the most appropriate strategies to control pollutant discharges (i.e., setting, updating, or maintaining a local limit; or removing a current local limit that is no longer necessary).

Table 5.1 - Water and Sludge Quality Criteria					
Pollutant	For Wildcat Hill WWTP			For Rio de Flag WRP	
	Most Stringent Effluent Criterion (mg/L) [1]	Source of Effluent Criterion	Most Stringent Sludge Criterion (mg/kg) [2]	Most Stringent Effluent Criterion (mg/L) [1]	Source of Effluent Criterion
Metals					
Antimony	0.006	AWQS	-	0.006	AWQS
Chromium	0.1	APP, AWQS	3000	0.1	APP, AWQS
Copper (Interim Limit)	0.0359	AZPDES [3]	1500	-	NA
Copper (New Limit)	0.018	AZPDES [3]	NA	0.018	AZPDES [3]
Cyanide (Total)	0.008	AZPDES [3]	NA	0.008	AZPDES [3]
Lead	0.00393	AZPDES [3]	300	0.00432	AZPDES [3]
Mercury	0.0002	AZPDES [3]	17	0.0002	AZPDES [3]
Selenium	0.002	AZPDES [3], SWQS	100	0.002	AZPDES [3], SWQS
Silver	0.0048	AZPDES [3]	-	-	NA
Volatile Organic Compounds					
Benzene	0.005	APP, AWQS	NA	0.005	APP, AWQS
Semivolatile Organic Compounds					
BEHP	0.006	AWQS	NA	0.006	AWQS

- = No Standard; NA = Not Applicable

(1) Most stringent effluent criterion based on AZPDES, APP, SWQS, and AWQS.

(2) Most stringent sludge criterion based on federal and state requirements.

(3) Effluent criterion used was the AZPDES monthly average.

Table 5.2 - Inhibition Thresholds for Wildcat Hill WWTP							
Pollutants of Concern	Biofiltration [1]		Anaerobic Digestion				
	Inhibitory (mg/L)[2]	Most Stringent Criterion (mg/L)	Inhibitory (mg/L)[2]	Strongly Inhibitory (mg/L)[3]	Severely Inhibitory (mg/L)[3]	Threshold Inhibitory (mg/L)[3]	Most Srringent Criterion (mg/L)
Metals							
Antimony	-	-	-	-	-	-	-
Chromium	3.5-67.6	3.5	-	-	-	-	-
Copper	-	-	40	0.5(D), 50-70(T)	0.5 (D)	1-10(D), 40(T)	40
Cyanide (Total)	30	30	1-100	-	-	1-4(D)	1.0
Lead	-	-	340	-	-	340 (T)	340
Mercury	-	-	-	-	-	13 - 65(D)	65
Selenium	-	-	-	-	-	-	-
Silver	-	-	13-65(D)	-	-	-	65
Volatile Organic Compounds							
Benzene	-	-	-	-	-	-	-
Semivolatile Organic Compounds							
BEHP	-	-	-	-	-	-	-

Notes:

- = No Standard; D= dissolved; T = total

(1) No inhibition threshold were available for biofiltration. Inhibition values for trickling filters were used instead.

(2) Local Limits Development Guidance, Appendix H - Literature Inhibition Values, July 2004. (References EPA's Guidance Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program, November 1987, which references other sources). Reference indicates no distinction between total or dissolved pollutant inhibition thresholds.

(3) Design of Municipal Wastewater Treatment Plants, 4th ed. WEF Manual of Practice No. 8 (WEF and ASCE), 1998.

Table 5.3 - Inhibition Thresholds for Rio de Flag WRP							
Pollutants of Concern	Activated Sludge			Nitrification			
	Inhibitory (mg/L)[1]	Inhibitory (mg/L)[2]	Most Sringent Criteria (mg/L)	Inhibitory (mg/L)[1]	Inhibitory (mg/L)[2]	Inhibitory (mg/L)[3]	Most Stringent Criteria (mg/L)
Metals							
Antimony	-	-	-	-	-	-	-
Chromium	1 - 100	-	1.0	0.25 - 1.9	-	-	0.25
Copper	1.0	0.50	0.50	0.05 - 0.48	0.05	230	0.5 [4]
Cyanide (Total)	0.1 - 5	0.3 - 100	0.10	0.34 - 0.5	-	17	0.34
Lead	0.1-100	0.10	0.10	0.50	-	0.50	0.50
Mercury	0.1 - 1	0.10	0.10	-	-	-	-
Selenium	-	-	-	-	-	-	-
Silver	0.25 - 5	9.0	0.25	-	-	-	-
Volatile Organic Compounds							
Benzene	100 - 500	-	100.0	-	-	13	13
Semivolatile Organic Compounds							
BEHP	-	-	-	150	-	-	150

Notes:

- = No Standard

(1) Local Limits Development Guidance, Appendix H - Literature Inhibition Values, July 2004. (References EPA's Guidance Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program, November 1987, which references other sources). Reference indicates no distinction between total or dissolved pollutant inhibition thresholds.

(2) Activated Sludge, 2nd ed. Water Environment Federation Manual of Practice OM-9, 2002. Reference indicates no distinction between total or dissolved pollutant inhibition thresholds.

(3) Biological and Chemical Systems for Nutrient Removal (WEF), 1998. Reference indicates no distinction between total or dissolved pollutant inhibition thresholds.

(4) Based on literature review documented in 2002 Local Limits Study [1].

Table 5.4 - Evaluation of Sampling Data for ORE Calculation						
Pollutants of Concern	**Wildcat Hill WWTP**			**Rio de Flag WRP**		
	# Detected results		**# pairs available**	**# Detected results**		**# pairs available**
	influent	**effluent**		**influent**	**effluent**	
Metals						
Antimony	0	0	0	0	0	0
Chromium	4	0	4	2	1	2
Copper	7	7	7	7	7	7
Cyanide (Total)	0	0	0	0	0	0
Lead	7	1	7	5	4	5
Mercury	6	0	6	0	0	0
Selenium	2	0	2	1	0	1
Silver	5	0	5	7	0	7
Volatile Organic Compounds						
Benzene	0	0	0	0	0	0
Semivolatile Organic Compounds						
BEHP	7	6	7	7	0	7

Table 5.6 - Previous Studies and Literature Overall Removal Efficiencies (%)								
Pollutant of Concern	2002 Local Limits Study [1]		1993 Local Limits Study [1]		1987 EPA Guidance [2]		1992 RREL [3]	
	Wildcat Hill WWTP	Rio de Flag WRP	Wildcat Hill WWTP	Rio de Flag WRP	Trickling Filter	Activated Sludge Treatment	Trickling Filter	Activated Sludge Treatment
Metals								
Antimony	36 (L)	36 (L)	NA	NA	NA	NA	NA	NA
Chromium	55 (L)	82 (L)	55 (L)	82 (L)	55	82	NA	85-94.6
Copper	71 (S)	86 (L)	71 (S)	86 (L)	61	86	NA	33-89
Cyanide (Total)	59 (L)	69 (L)	59 (L)	69 (L)	59	69	NA	58-91.7
Lead	76 (S)	61 (L)	76 (S)	61 (L)	55	61	NA	83-92.1
Mercury	35 (S)	60 (L)	35 (S)	60 (L)	50	60	NA	43-68
Selenium	25 (L)	50 (L)	25 (L)	50 (L)	NA	50	NA	50-92.8
Silver	48 (S)	75 (L)	48 (S)	75 (L)	66	75	NA	50-72
Volatile Organic Compounds								
Benzene	75 (L)	80 (L)	NA	NA	75	80	NA	NA
Semivolatile Organic Compounds								
BEHP	58 (L)	72 (L)	NA	NA	58	72	3-79	0-33

Notes:

(1) Wildcat Hill WWTP Development of Local Pretreatment Limits (Final Report) for the City of Flagstaff, Malcolm Pirnie, Inc. June 30, 1993.

(2) EPA Guidance Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program, November 1987.

(3) EPA Risk Reduction Engineering Laboratory Treatability Database, Version 5.0, 1992.

NA = Not Available

S = Based on site-specific sampling data

L = Based on a literature value

Table 5.7 - Previous Studies and Literature Primary Removal Efficiencies (%)			
Pollutant of Concern	**2002 Local Limits Study [1]**	**1993 Local Limits Study [1]**	**1987 EPA Guidance [2]**
Metals			
Antimony	0 (NR)	NR	NR
Chromium	0 (S)	0 (S)	27
Copper	0 (S)	0 (S)	22
Cyanide (Total)	27 (L)	27 (L)	27
Lead	0 (S)	0 (S)	57
Mercury	20 (S)	20 (S)	10
Selenium	NA	NA	NA
Silver	0 (S)	0 (S)	20
Volatile Organic Compounds			
Benzene	25 (L)	25 (L)	25
Semivolatile Organic Compounds			
BEHP	0 (NR)	NR	NR

Notes:

(1) Wildcat Hill WWTP Development of Local Pretreatment Limits (Final Report) for the City of Flagstaff, Malcolm Pirnie, Inc. June 30, 1993.

(2) EPA Guidance Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program, November 1987.

NR = Not reported in any available source

S = Based on site-specific sampling data

L = Based on a literature value

Table 5.8 - Selected Removal Efficiencies for AHL Analysis						
Pollutant of Concern	**OREs (%)**				**PREs (%)**	
	Wildcat Hill WWTP	**Source**	**Rio de Flag WRP**	**Source**	**Both Plants**	**Source**
Metals						
Antimony	36	Literature Value	36	Literature Value	0	Not Reported
Chromium	51	2004-2005 Sampling	88	2004-2005 Sampling	0	1992 Sampling
Copper	80	2003 Sampling	89	2003 Sampling	0	1992 Sampling
Cyanide (Total)	59	Literature Value	69	Literature Value	27	Literature Value
Lead	86	2003 Sampling	70	2003 Sampling	0	1992 Sampling
Mercury	84	2003 Sampling	60	Literature Value	20	1992 Sampling
Selenium	25	Literature Value	50	Literature Value	0	Not Reported
Silver	78	2003 Sampling	88	2003 Sampling	0	1992 Sampling
Volatile Organic Compounds						
Benzene	75	Literature Value	80	Literature Value	25	Literature Value
Semivolatile Organic Compounds						
BEHP	89	2003 Sampling	96	2003 Sampling	0	Not Reported

6.0 DETERMINATION OF LIMITS BY HEADWORKS LOADINGS

6.1 GENERAL

Effluent limitations control industrial discharges of pollutants that pose risks to the WWTPs. The WWTPs can accept limited loadings of some pollutants with minimal risk of pass-through or interference. These loadings, which can be determined objectively, are known as MAHLs. The MAHL for each pollutant is site-specific, depending upon WWTP or WRP flow rates, the ability of the plants to remove the pollutant, and the environmental regulatory requirements (i.e., permit limits) that the plants must meet.

For each of the 9 POC at Wildcat Hill WWTP and Rio de Flag WRP a local limit was calculated from its MAHL. Safety factors were developed to reserve a percentage of the MAHL for industrial growth, analytical uncertainty, and slug loadings and background loadings were determined and subtracted from each MAHL. The remaining loading for each pollutant (i.e., the MAHL less the safety allowance and background loading) represents the allowable industrial loading (AIL). The local limits were calculated by dividing the AILs by the total wastewater flow from all SIUs, which means these limits are applied to all SIUs uniformly.

Three scenarios were considered for the limits calculation, consisting of the current biological processes at both plants based on site-specific data and also an estimate of the future conditions at Wildcat Hill WWTP once the conversion to activated sludge processes is operational between May and October 2007. The addition of this future scenario at Wildcat Hill WWTP allowed for the evaluation of alternative control mechanisms for compliance with the AZPDES final permit limit for copper, which will be effective in July 28, 2008. For this study, the activated sludge-based calculated local limits for the Wildcat Hill WWTP are used only for comparison purposes and to formulate action plans complementing the implementation of local limits, but not for calculation of proposed limits.

A methodology was defined based upon the analysis of critical factors and the comparison of current SIU discharges and the calculated local limits to determine the need for local limits, the feasibility of implementing updated local limits, and/or the use of other control strategies (i.e., source reduction programs, BMPs).

6.2 LOADING ALLOCATION

The MAHL for a given pollutant is the lowest or most stringent AHL, such that all end uses, as well as the treatment facility processes, are protected. The MAHL calculation included the following steps:

- Compilation of the applicable criteria such as permit effluent limitations and inhibition thresholds. Both interim and final AZPDES copper limits for Wildcat Hill WWTP were used for the AHL calculation.
- Selection of removal efficiencies corresponding to the current biological processes at each plant (i.e., biotowers and trickling filters at Wildcat Hill WWTP and activated sludge at Rio de Flag WRP) and the future conversion of the tricking filters to activated sludge facilities at Wildcat Hill WWTP by mid-2007, as documented in the 2004 Basis of Design Report [4]. The removal efficiencies from Rio de Flag WRP were used as an estimate for the activated sludge scenario of Wildcat Hill WWTP.
- Calculation of WWTP influent flows and biosolids production projections for the year 2009 for each plant, using the assumption that 20 percent of the wastewater flows from the Rio de Flag WRP service area are diverted to the Wildcat Hill WWTP.

The MAHLs for three scenarios described above are presented in Table 6.1.

Table 6.1 - MAHLs Summary

Pollutants of Concern	MAHLs (lb/day)		
	Wildcat Hill WWTP		Rio de Flag WRP
	With Tricking Filters	With Activated Sludge	
Metals			
Antimony	0.35	0.35	0.21
Copper (1)	3.33	6.06	3.61
Cyanide (Total)	0.72	0.96	0.57
Lead	1.05	0.38	0.32
Mercury	0.046	0.019	0.011
Selenium	0.10	0.15	0.088
Silver	0.81	1.48	5.52
Volatile Organic Compounds			
Benzene	0.74	0.93	0.55
Semivolatile Organic Compounds			
BEHP	2.02	5.56	3.31

Notes:
(1) MAHL based on AZPDES final copper limit.

The MAHL is divided among three general components: background loading, safety allowance, and allowable industrial loading, as described in the following sections.

6.2.1 Projected Background Loadings

The 2009 projected pollutant loadings for each background location were calculated by multiplying the average concentrations for each POC by the corresponding 2009 projected average flows. Tables 6.2 and 6.3 present the 2009 loading calculation for the background sources discharging to the Wildcat Hill WWTP and Rio de Flag WRP.

6.2.2 Safety Allowance

The USEPA guidance manuals [6, 3] generally recommend a 10 percent safety factor at a minimum to account for WWTP data variability, industrial user's slug loadings, number and size of each industrial user, among others. Two types of safety factors were developed: a safety factor for industrial growth and a safety factor for analytical uncertainty and slug loadings.

The safety factor for industrial growth reserves a portion of the MAHL for expansion of existing industrial facilities and for new industrial development. The methodology for developing the safety factors for the Wildcat Hill WWTP and Rio de Flag WRP is consistent with the methodology used in the 1993 and 2002 local limits studies [2, 1]. The methodology used to estimate the safety factor for industrial growth was based on the differences in residential and industrial wastewater generation. Appendix D presents the 2002 study safety factor calculation, which used 1993 and 2000 flow rates.

Although the calculated safety factor for the 2002 study was 2 percent, the safety allowance for industrial growth of five percent, used in the 1993 Local Limits Study, was selected for the local limits calculation, because it was protective through 2009 and allowed for variability of industrial growth in the two service areas. A safety allowance of ten percent was reserved from the MAHL for slug loadings and analytical uncertainty. Thus, a total safety allowance of 15 percent was reserved for the Wildcat Hill WWTP and the Rio de Flag WRP.

To confirm the applicability of the total safety allowance of 15 percent, the 1993 annual average flow was compared to the 2003 flows, as presented in Table 6.4.

Table 6.4 – Calculation of Growth Rate Based on 1993 and 2002 Methodology

Flows (mgd)	1992	2003	Difference	Percent Difference	Annual Growth Rate
Total SIU	0.834	0.789	-0.0451	-5.4%	-0.5%
Total Influent	5.500	5.867	0.367	6.7%	0.6%
Difference (delta in growth rates)				-12.1%	-1.1%
Growth Rate (to 2009)					-6.4%

The relative growth rate is the difference between the SIU growth rate and the total influent growth rate projected over the time period of interest. A positive relative growth rate implies that SIU growth rate will exceed total influent growth rate over the time period; a negative relative growth rate implies that total influent growth will exceed the SIU growth rate. In the latter case, no safety factor is needed for industrial growth. The results of the safety factor calculation using the 2003 industrial and total flows indicated the following:

- The industrial growth rate for the 1992 to 2003 interval was lower than the total growth rate, which indicates that industrial flows declined from 1993 to 2003, while the total influent flows increased.
- The growth rate in the industrial sources is not projected to exceed the total growth rate projected for the Wildcat Hill WWTP and Rio de Flag WRP by 2009, and the relative growth rate for the six-year period between 2003 and 2009 is therefore negative (-6.4 percent).
- No safety factor for industrial growth is required.

In order to consider the results of previous studies, the current calculation based on the 2003 recorded flows, and the City's knowledge of future industrial growth, the safety factors of 10 percent and 15 percent were used for calculating the safety allowance to account for industrial growth, slug loadings, and analytical uncertainty.

6.2.3 Allowable Industrial Loading

The AIL is the fraction of the MAHL that can be allocated to SIUs after accounting for projected background loadings and for the safety allowance. The calculation of the AIL is described by the following equation:

$$AIL = MAHL - BL - SA$$

6.2.4 UCL Calculation

The uniform concentration limit (UCL) method allocates the AIL to each SIU by calculating one limit that applies to every controlled discharger, including those that do not discharge the pollutant. The limits are calculated by applying the following equation:

$$UCL = AIL / Q_{SIUs} \times 8.34$$

Where:
UCL = Uniform concentration limit in mg/L
AIL = Allowable industrial loading in lb/day
Q_{SIUs} = Projected 2009 SIU flows in mgd
8.34 = Unit conversion factor [(lb/million gallons) / (mg/L)]

The UCLs were calculated using USEPA PRELIM Version 5.0 [12] equations in a Microsoft Excel-based model. The UCL calculations with safety factors of 10 percent and 15 percent for the Wildcat Hill WWTP (both scenarios) and Rio de Flag WRP are presented in Tables 6.5 to 6.10. The UCLs based on the safety factor of 15 percent are slightly lower than the UCLs calculated based on the safety factor of 10 percent, and represent a more conservative approach that is consistent with the methodology used in the 1993 and 2002 local limits studies [2, 1].

Table 6.11 compiles the most stringent UCLs (with safety factor of 15 percent) at each plant for each POC, the controlling criteria, and current local limits.

Table 6.11 - Summary of UCLs based on Safety Factor of 15%

Pollutants	Controlling Criteria - Value		UCL (mg/L)			Most Stringent UCL	Current Local Limits (mg/L)
	WCH WWTP	RDF WRP	WCH WWTP (1)	WCH WWTP (2)	RDF WRP		
Metals							
Antimony	AWQS - 0.006 mg/L	AWQS - 0.006 mg/L	0.14	0.14	0.030	0.030	No limit
Copper	AZPDES - 0.018 mg/L	AZPDES - 0.018 mg/L	<0	1.03	0.31	0.31	1.0
Cyanide	AZPDES - 0.008 mg/L	AZPDES - 0.008 mg/L	0.28	0.37	0.081	0.081	0.240
Lead	AZPDES - 0.00393 mg/L	AZPDES - 0.00432 mg/L	0.38	0.12	0.041	0.041	0.98
Mercury	AZPDES - 0.0002 mg/L	AZPDES - 0.0002 mg/L	0.017	0.0060	0.0015	0.017	0.03
Selenium	AZPDES - 0.002 mg/L	AZPDES - 0.002 mg/L	0.019	0.038	0.0091	0.0091	No limit
Silver	AZPDES - 0.0048 mg/L	Inhibition - 0.25 mg/L	0.30	0.56	0.79	0.30	0.72
Volatile Organic Compounds							
Benzene	APP – 0.005 mg/L	APP – 0.005 mg/L	0.29	0.36	0.079	0.079	Prohibit
Semivolatile Organic Compounds							
BEHP	AWQS - 0.006 mg/L	AWQS - 0.006 mg/L	0.062	1.45	0.28	0.062	No limit

Notes:
(1) UCL based on trickling filter removal efficiency at Wildcat Hill WWTP (current conditions).
(2) UCL based on estimated activated sludge removal efficiency at Wildcat Hill WWTP (future conditions).
WCH = Wildcat Hill ; RDF = Rio de Flag

In general, the estimated activated sludge-based UCLs for Wildcat Hill WWTP (future conditions) were less stringent than the trickling filters-based UCLs at Wildcat Hill WWTP (current conditions) and the activated sludge-based UCLs at Rio de Flag WRP. This is due to the use of higher pollutant removal efficiencies commonly observed with activated sludge processes.

The UCL comparison for these scenarios suggests that after the conversion of Wildcat Hill WWTP to activated sludge and providing that the wastewater flow split remains the same assumed in this study (i.e., 80/20 flow split), the UCLs for copper and BEHP may be controlled by criteria at the Rio de Flag WRP. For this study, the activated sludge-based UCLs for the Wildcat Hill WWTP are used only for comparison purposes and to formulate action plans complementing the implementation of local limits, but not for calculation of recommended local limits.

For the five pollutants currently regulated by local pretreatment ordinances (e.g., copper, cyanide, lead, mercury, and silver), the calculated UCLs were more stringent than the current interim local limits. Four of these UCLs were based on AZPDES permit limitations for the Rio de Flag WRP and one for Wildcat Hill WWTP (with trickling filters).

One of the reasons why most of the ULCs are controlled by Rio de Flag WRP criteria is the considerable increase of the projected industrial flows to this plant due to the SCA flow diversion which occurred in January 2006 (e.g., the AIL is divided by a higher industrial flow, resulting in lower concentration values for the UCLs).

For copper, UCLs were calculated to account for the current AZPDES effluent permit limitations for both plants (i.e., 0.036 mg/L interim limit for Wildcat Hill WWTP and 0.018 mg/L for Rio de Flag WRP) and for the AZPDES final limit for the Wildcat Hill WWTP of 0.018 mg/L. However, the AIL and UCL for copper based on the final AZPDES limit for Wildcat Hill WWTP (with trickling filters) could not be calculated, because the background loadings and safety allowance were greater than the MAHL. The most stringent calculated UCL for copper is based on the AZPDES limit for Rio de Flag WRP.

For mercury, the most stringent UCL of 0.0015 mg/L was calculated based on the AZPDES permit limitation for Rio de Flag WRP and the removal efficiency for this plant. Due to no detected values of mercury in the influent at Rio de Flag WRP, a site specific removal efficiency could not be calculated and a literature value was used to determine the UCL. The second most stringent UCL (0.017 mg/L) based on site-specific data at Wildcat Hill WWTP was also considered for the limits feasibility evaluation.

6.3 FEASIBILITY OF IMPLEMENTING LIMITS

A methodology was defined based upon a decision matrix that included the evaluation of critical factors to characterize the pollutants, the comparison of the most stringent UCLs to the SIU discharges, and a "common sense" test to determine the impact of implementing new local limits for the 9 pollutants. The methodology was based on the 1987 and 2004 USEPA guidance manuals [6, 3] and incorporated the findings of the AHL analyses presented in Chapter 5.

6.3.1 Critical Factors

Critical factors were identified to facilitate and maintain consistency in the analysis of each pollutant. The factors used to characterize the pollutants were:

- Does the pollutant have an existing local limit?
- Was the pollutant in effluent samples detected above the RLs?
- Have the Wildcat Hill WWTP or Rio de Flag WRP had a pollutant effluent violation or exceedance in the last five years?
- Influent loading to MAHL for Wildcat Hill WWTP and Rio de Flag WRP?
- Daily maximum influent loading to MAHL for Wildcat Hill WWTP and Rio de Flag WRP?

The results of the critical factors are presented as follows:

- Five years of effluent data for the Wildcat Hill WWTP and Rio de Flag WRP was not used for this analysis. The results of the Annual Pretreatment Compliance Reports for 2002 to 2005 and the sampling results collected during the 2003 sampling event (e.g., October and November 2003) were used instead. The Annual Pretreatment Compliance Reports indicated that Wildcat Hill WWTP had one zinc violation in 2002, one silver violation in 2003, and one selenium violation in 2004. Rio de Flag WRP did not have any NPDES permit violation between 2002 and 2005. The 2003 sampling events results indicated that the Wildcat Hill WWTP had copper effluent concentrations that exceeded the final AZPDES effluent limitation of 0.18 mg/L and BEHP effluent concentrations that exceeded the APP effluent limitation of 0.006 mg/L in four occasions.
- Antimony, cyanide, mercury, selenium, silver and benzene in effluent samples from Wildcat Hill WWTP and Rio de Flag WRP were not detected above the RLs. The RLs used by the laboratory were reviewed and the RLs for antimony, mercury, selenium, silver, and benzene were equal or lower than the effluent criteria. Although the RL for cyanide was higher than the AZPDES effluent criteria, the RL was equal to the previous NPDES effluent criteria. The City has revised the RL for cyanide to meet the AZPDES effluent criteria.
- In the 1993 and 2002 local limits studies [2, 1], pollutants with annual average influent loading to MAHL ratios lower than 10 percent were assumed to have a low

risk for pass through or interference at the plants. The 2004 USEPA manual [3] suggests that pollutants with annual average influent loading to MAHL ratios greater than 60 percent and daily maximum influent loading to MAHL ratio greater than 80 percent need measures such local limits to control industrial discharges.

- Annual average influent loading to MAHL ratios for antimony, silver, and benzene were lower than 10 percent, which suggests that local limits to control industrial discharges are not necessary.
- Annual average influent loading to MAHL ratios for cyanide, lead, selenium, and mercury were greater than 10 percent but lower than 60 percent. This indicates that the current local limits may need to be updated.
- For copper and BEHP annual average influent loading to MAHL ratios and daily maximum influent loading to MAHL ratios were greater than 60 percent and 80 percent, respectively. This suggests the need for implementing local limits or other measures to control the industrial discharges of these pollutants.

6.3.2 SIU Discharges and UCL Comparisons

The SIU pollutant discharge concentrations were graphed and compared to the average domestic and commercial concentrations, reporting limits (RLs), the most stringent UCLs, and the current local limits. A total of 68 sampling results per pollutant were collected between January 2004 and August 2005 and used for preparing the graphs for the 9 pollutants (Appendix E). The major observations from the SIU pollutant discharge concentration graphs are summarized as follows:

- SIU sampling results for antimony and benzene were not detected above the RL.
- Most of the SIU pollutant concentration discharges evaluated were greater at or above the background average concentrations.
- The most stringent UCL for selenium were more than four times higher than the SIU discharges. None of the SIUs are currently pretreating to remove selenium; therefore a control measure such as a local limit may not be necessary to maintain the current selenium levels.
- The most stringent UCL for cyanide was lower than the current local limit and higher than the SIU cyanide discharges.
- The most stringent UCL for silver was lower than the current local limit and higher than the SIU silver discharges.
- The most stringent UCL for lead was lower than the current local limit and higher than most SIU discharges. Six SIU lead discharges exceeded the most stringent UCL of 0.041 mg/L:
  - Four discharges from Mission Linen ranging from 0.046 mg/L to 0.11 mg/L.
  - Two discharges from Nestle Purina ranging from 0.047 mg/L and 0.049 mg/L.

- The most stringent UCL for mercury was lower than the current local limit and higher than most SIU discharges. Only three SIU mercury discharges exceeded the most stringent UCL of 0.0015 mg/L based on Rio de Flag WRP, one from NAU Biology at 0.0135 mg/L, one from NAU Dome at 0.0018 mg/L, and one from Nestle Purina at 0.007 mg/L. No mercury SIU discharge was higher than the second most stringent UCL of 0.017 mg/L based on Wildcat Hill WWTP.
- The UCL for copper based on the AZPDES permit limit of 0.018 mg/L for Wildcat Hill WWTP could not be calculated because the safety allowance and background loading were higher than the MAHL. The second most stringent UCL for copper of 0.31 mg/L, based on the AZPDES permit limit for Rio de Flag WRP, was used for this comparison and was lower than the existing local limit and higher than some of the SIU discharges. However, four SIU copper discharges exceeded 0.31 mg/L:
  - Three discharges from Mission Linen ranging from 0.35 mg/L to 0.69 mg/L
  - One discharge from NAU Biology at 0.87 mg/L
  - Two discharges from Nestle Purina at 0.31 mg/L and 0.32 mg/L
- The UCL for BEHP based on the AWQS of 0.006 mg/L for Wildcat Hill WWTP was higher than most SIU discharges. However, eight discharges exceeded 0.062 mg/L:
  - Seven discharges from Mission Linen ranging from 0.27 mg/L and 0.64 mg/L
  - One discharge from Flagstaff Medical Center at 0.088 mg/L

6.3.3 Common Sense Test

The 2004 USEPA guidance manual [3] recommends conducting a "common sense test" to assess if the calculated UCLs are reasonable and achievable by asking the following questions:

- Are limits technologically achievable?
- Can the WWTPs and dischargers determine compliance with the limits (i.e., reporting limits are lower than local limits)?
- Are the limits sensible based on actual conditions at the WWTPs?

The results of this test, summarized in Table 6.12, showed that only copper and BEHP did not pass the test and may require different control strategies to reduce loadings to the WWTPs.

Table 6.12 – Common Sense Test Results	
Pollutant	**Reason for Not Passing Test**
Copper	• The 2003 manhole sampling results suggests that the domestic and NIND sectors are major contributors of copper to the plants. In addition, results of preliminary tap water sampling activities conducted by the City suggests that copper levels in the SIUs source water have copper levels comparable to the most stringent UCL of 0.31 mg/L. • Updating the local limit to 0.31 mg/L is not a practical and feasible measure to control or reduce copper levels. A copper reduction plan for background sources would be necessary.
BEHP	• Background contributions represent the main source of BEHP to both plants. • There is currently no technology available to remove BEHP in wastewater. Therefore, a limit of 0.062 mg/L is not technologically feasible and other control mechanisms, such as BMPs, should be considered.

6.4 INDUSTRIAL CONTROL STRATEGIES

The application of the components of the decision matrix to each pollutant at the Wildcat Hill WWTP and Rio de Flag WRP resulted in the organization of the pollutants into groups and provided the basis for establishing the most appropriate industrial control strategies. The compilation of the decision matrix results is presented in Table 6.13. The preliminary recommendations developed for the 10 pollutants evaluated are summarized in Table 6.14 as follows:

Table 6.14 – Summary of Industrial Control Strategies	
Pollutant	**Recommendations**
Copper	• Maintain current local limit of 1.0 mg/L. • Implement programs to reduce copper contributions to the plants. • Conduct re-evaluation of background loadings, removal efficiency, MAHL, and UCL once the copper reduction plan has been implemented and conversion to activated sludge is completed at Wildcat Hill WWTP.
Lead, mercury, and silver	• Update current local limits using most stringent UCLs based on site-specific removal efficiencies and background loadings. • Conduct re-evaluation of removal efficiency, MAHL, and UCL once the conversion to activated sludge is completed at Wildcat Hill WWTP.
Cyanide	• Maintain current local limit of 0.24 mg/L. • Conduct re-evaluation of removal efficiency, MAHL, and UCL once the conversion to activated sludge is completed at Wildcat Hill WWTP.
Benzene	• Do not set local limit based on effluent criteria. • Implement fume toxicity screening level of 0.35 mg/L for benzene, as documented in the 2002 Local Limits Study [1].

Table 6.14 – Summary of Industrial Control Strategies (Cont.)	
Pollutant	**Recommendations**
BEHP	• Do not set daily average local limit. • Implement other control measures such as best management practices.
Antimony and selenium	• Do not set daily average local limit. Local limits based on effluent criteria are not necessary. • Continue categorical IU monitoring, as applicable.

The discussion of the recommendations and action plans are described in the following sections. The recommendations and action plans are in addition to the 2002 Local Limits recommendations, which may be found in Appendix F.

6.4.1 Update Existing Local Limit

The application of the decision matrix provided the basis to update the local limits for copper, cyanide, lead, mercury, and silver. The majority of the effluent concentrations are well-controlled and most of the times are not detected above the RLs, supporting the continued use of local limits to control industrial discharges.

Copper

Copper influent loadings to the Wildcat Hill WWTP are significant and need to be reduced to meet the new final AZPDES permit limit of 0.0018 mg/L which becomes effective in July 2008. The AIL and UCL for copper based on the final AZPDES limit for Wildcat Hill WWTP (with trickling filters) could not be calculated, because the background loadings and safety allowance were greater than the MAHL. The UCL of 0.31 mg/L based on the AZPDES limit for Rio de Flag WRP is also affected by the high background loading and would cause SIU violations. SIUs such as Mission Linen, NAU Biology, and Nestle Purnia have discharged copper in concentrations greater than the most stringent calculated UCL at Rio de Flag WRP.

The average background concentrations (0.084 and 0.076 mg/L, Wildcat Hill WWTP and Rio de Flag WRP, respectively) and overall removal efficiencies are based on site-specific data at both plants. The influent mass balances are acceptable at 92% at Wildcat Hill WWTP and high at 130% at Rio de Flag WRP. The high influent mass balance indicated that the background loading and/or SIU loadings to the Rio de Flag WRP may be overestimated. This overestimation increases the conservativeness of the UCL for Rio de Flag WRP.

The high background loadings of copper at both plants have reduced the amount available to the SIUs and have made the calculated UCLs negative or low. The implementation of

background source reduction plan (see following Section 6.4.2) are critical in facilitating compliance of the final AZPDES copper limit at Wildcat Hill WWTP, once it becomes effective in July 2008.

A more detailed review of the copper loadings from SIUs have been compiled in this section to assist the City in understanding the sources of copper from its SIUs and where possible reductions could be made. Promotion of BMPs and best available technologies for treatment to reduce copper loadings from the SIUs is recommended. Table 6.15 presents the copper loading discharged at each plant for each SIU, the percent that loading is to the MAHL, and the SIU copper loading as a percentage of total SIU copper loading.

Two outfalls from NAU (Dome and Biology) and Mission Linen discharge 72% of the loading to both of the plants. However, the SIUs combined discharge approximately 6% of the MAHL for copper to each plant. For comparison, the background loading to MAHL is 72% at Wildcat Hill WWTP and 26% at Rio de Flag WRP. At the time of 2003 sampling, SCA Tissue was discharging its flow to Wildcat Hill WWTP as reflected in Table 6.15. The SIU now discharges to Rio de Flag WRP which would increase the copper loading at that plant.

Table 6.15 - SIU Loadings and MAHLs Summary

MAHL	Wildcat Hill WWTP		Rio de Flag WRP		SIU Loading /Total Loading
	3.21	lb/day	3.61	lb/day	
SIUs	SIU Loading (lb/day)	SIU Loading / MAHL	SIU Loading (lb/day)	SIU Loading / MAHL	
NAU – Dome	0.033	1.0%	0.13	3.6%	33%
NAU – Biology	0.024	0.8%	0.10	2.8%	25%
NAU – Biochemistry	0.0006	0.0%	0.0024	0.1%	1%
Flagstaff Medical Center	0.0094	0.3%	0.038	1.0%	9%
W.L. Gore - Woody Mountain	0.0056	0.2%	0.022	0.6%	6%
W.L. Gore - Echo Ridge	0.0008	0.03%	0.0033	0.1%	1%
Joy Cone	NA	NA	0.0032	0.1%	1%
SCA Tissue	0.012	0.4%	NA	NA	2%
Mission Linen & Uniform (Huntington Dr.)	0.071	2.2%	NA	NA	14%
Nestle Purina	0.030	0.9%	NA	NA	6%
Pepsi Cola Bottling Company	0.0074	0.2%	NA	NA	2%
W.L. Gore - 4th Street	0.0036	0%	NA	NA	1%
Total	0.20	6.1%	0.30	8.3%	100%

Notes:
NA : Not applicable. SIU only discharges to one of the plants.

At this point in the City's development and implementation of the copper reduction plan, the recommendations and action plans for copper are:

- Maintain the current limit of 1.0 mg/L for the SIUs
- Implement programs to reduce background copper contributions to the plants
- Promote copper reduction BMPs and best available technologies for treatment at the SIUs
- Continue on-going pretreatment program monitoring
- Conduct re-evaluation of background loadings, removal efficiency, MAHL, and ULC once the copper reduction plan has been implemented and the conversion to activated sludge is completed at Wildcat Hill WWTP

Lead

The annual average influent loadings to MAHL are low to moderate (14% and 15%) at both plants and the effluent concentrations have not caused violations (average concentrations 0.00057 mg/L at Wildcat Hill WWTP and 0.0020 mg/L at Rio de Flag WRP). The background concentrations (0.0021 mg/L and 0.0017 mg/L, at Wildcat Hill WWTP and Rio de Flag WRP, respectively) and removal efficiencies are based on site specific data from both plants. The influent mass balance at Wildcat Hill WWTP (55%) is poor so the background and/or SIUs loadings may be underestimated. The influent mass balance at Rio de Flag WRP (110%) is acceptable.

Lead is an industrial pollutant and discharged in concentrations greater than background. The most stringent UCL of 0.041 mg/L from Rio de Flag WRP may cause compliance issues with some of the SIUs. This updated local limit is in accordance with the AZPDES permits and new flow conditions, and it provides for future growth in the service areas. The SIUs should consider waste minimization and pollution prevention practices to reduce the lead discharges to the sewer.

The recommendations and action plans for lead are:

- Update current local limit from 0.98 mg/L to 0.041 mg/L
- Continue on-going pretreatment program monitoring
- Conduct re-evaluation of removal efficiency, MAHL, and ULC once the conversion to activated sludge is completed at Wildcat Hill WWTP

Mercury

Although moderate annual average influent loadings to MAHL (42% and 15%), Wildcat Hill WWTP and Rio de Flag WRP, respectively) and not detected in the effluent, mercury has been detected at SIUs, in particular NAU and Nestle Purina, in concentrations greater than the most stringent UCL at Rio de Flag WRP. The background concentrations

(0.00008 mg/L and 0.00003 mg/L, Wildcat Hill WWTP and Rio de Flag WRP, respectively) are based on site specific data. Due to many non-detected concentrations at SIUs such as NAU Biology, the influent mass balances at both plants were poor 15% at Wildcat Hill WWTP and 147% at Rio de Flag WRP. The poor influent mass balance closure for Wildcat Hill WWTP of 15% appears to be underestimating the background and/or SIU loadings to the plant.

The overall removal efficiency at Wildcat Hill WWTP is based on site-specific data. However, due to no detected values of mercury in the influent at Rio de Flag WRP, a site specific removal efficiency could not be calculated and a literature value was used. Because mercury is an industrial pollutant and the findings of this study suggest that it is necessary to maintain and update the local limit, the second most stringent UCL of 0.017 mg/L at Wildcat Hill WWTP based on site-specific removal efficiency data is recommended. Because the influent loadings and effluent concentrations at the plants show that the pollutant is controlled and that the majority of the SIUs discharge in concentrations below detection limits, the UCL of 0.017 mg/L will be protective of both plants. This updated local limit is in accordance with the AZPDES permits and new flow conditions, and it provides for future growth in the service areas. The SIUs should consider waste minimization and pollution prevention practices to reduce the mercury discharges to the sewer.

The recommendations and action plans for mercury are:

- Update current local limit from 0.030 mg/L to 0.017 mg/L
- Continue on-going pretreatment program monitoring
- Conduct re-evaluation of removal efficiency, MAHL, and ULC once the conversion to activated sludge is completed at Wildcat Hill WWTP

Silver

Although low influent loadings to MAHL at both plants and rarely detected in the effluent, there was an effluent violation of silver in 2003 and silver is discharged by SIUs. The background concentrations (0.0012 mg/L and not detected above the RL, Wildcat Hill WWTP and Rio de Flag WRP, respectively) and overall removal efficiencies are based on site-specific data at both plants. The influent mass balances are acceptable at 78% and 101% for Wildcat Hill WWTP and Rio de Flag WRP, respectively.

The limit is recommended to be maintained and updated based on the findings of this study. The current SIU discharges for silver are significantly lower than the most stringent UCL, which suggests that the implementation of the silver local limit of 0.30 mg/L is feasible. This updated local limit is in accordance with the AZPDES permits and new flow conditions, and it provides for future growth in the service areas. After the activated

sludge conversion is completed, the silver UCL for Wildcat Hill WWTP will probably change. At that time, the City should consider collecting samples at Wildcat Hill WWTP to assess if the plant is still protected with the silver local limit.

The recommendations and action plans for silver are:

- Update current local limit from 0.72 mg/L to 0.30 mg/L
- Continue on-going pretreatment program monitoring
- Conduct re-evaluation of removal efficiency, MAHL, and ULC once the conversion to activated sludge is completed at Wildcat Hill WWTP

Cyanide

Cyanide was non-detected in samples at the influent and effluent at both plants, the 2 domestic locations, and the NIND sampling location. The RL used for the 2003 sampling activities of 0.0097 mg/L is greater than the AZPDES effluent criteria of 0.008 mg/L; however, the City has lowered the RL to be equal to the AZPDES effluent criteria. Substituting one half the RL for the influent concentration, the estimated influent loading to MAHL is 22% and 14% at Wildcat Hill WWTP and Rio de Flag WRP, respectively.

Five of the SIUs and NHLW have had detections of cyanide in the samples. The background concentrations are estimated to be zero or close to zero (0.000008 mg/L) due to NHLW at Wildcat Hill WWTP. The removal efficiencies for both plants are based on literature values. The influent mass balance closures based on one half RL substitution for the influent were poor (15% and 11%, Wildcat Hill WWTP and Rio de Flag WRP, respectively). Because cyanide is an industrial pollutant and is detected at the SIUs and NHLW, maintaining the existing limit of 0.24 mg/L is recommended. Although this limit is greater than the most stringent UCL at Rio de Flag WRP (0.081 mg/L), it is comparable to the calculated UCL at Wildcat Hill WWTP (0.28 mg/L).

The recommendations and action plans for cyanide are:

- Maintain current local limit of 0.24 mg/L
- Continue on-going pretreatment program monitoring
- Conduct re-evaluation of removal efficiency, MAHL, and ULC once the conversion to activated sludge is completed at Wildcat Hill WWTP

Zinc

The 2002 Local Limits study recommended updating the zinc local limit to 1.4 mg/L and performing the influent mass balances to confirm source characterization. The zinc mass balance closures based on the 2003 sampling data improved in comparison to the mass balances in the 2002 study, which suggests that a better characterization of the background

loadings was accomplished. A headworks analyses was performed to evaluate the changes in the AZPDES permit limitations for zinc, changes in the collection system and the SIU flows, and the use of recent site-specific data. From that evaluation, the 2002 recommendation is deemed protective of both plants.

The recommendations and action plans for zinc are:

- Maintain current local limits of 1.4 mg/L
- Continue on-going pretreatment program monitoring.

6.4.2 Implement Other Control Strategies

The application of the decision matrix, specially the results of the common sense test, and the results of the fume toxicity screening documented in the 2002 Local Limits Study provided the basis for copper, benzene, and BEHP to have other control measures in addition to or instead of numeric local limits. Copper has an existing local limit, while benzene and BEHP does not. The following sections describe other control strategies applicable to copper, benzene, and BEHP.

Loading Reduction Plan for Copper

The calculation of a local limit based on the final AZPDES permit limitation for Wildcat Hill WWTP was not possible due to the current and projected copper background levels, which were greater than the MAHL. Currently, the domestic and NIND loadings are the main copper contributors to the Wildcat Hill WWTP due possibly to corrosion of plumbing systems, erosion of natural deposits, and others. The City is currently initiating a sampling program and developing a copper reduction plan in accordance with the Wildcat Hill WWTP AZPDES permit requirements.

The City is planning the conversion of the current trickling filters to activated sludge, which may address some of the special conditions for copper as described in Part V Section A of the AZPDES permit for this WWTP. This conversion, which increases the BOD_5 loading capacity and produces Class A+ reuse water, may also increase the copper removal mechanisms and assist the plant in complying with the final AZPDES limit of 0.018 mg/L. In order to confirm the benefits of the conversion to activated sludge towards meeting the copper AZPDES limit the City should consider the following action items:

- Reassess the flow split and, if different from the 80/20 flow split assumed in this study, recalculate the flow contributions from the domestic, NIND, and SIU flows to Wildcat Hill WWTP and Rio de Flag WRP.
- Conduct sampling at the influent and effluent of Wildcat Hill and recalculate the removal efficiencies, MAHL, and UCLs for copper.

- Document any other process change or service area change to update MAHL for copper in the next local limits evaluation.

The implementation of these activities, with the implementation of the copper reduction plan, will facilitate meeting the compliance schedule and support the City's efforts to reduce the copper loadings to Wildcat Hill WWTP.

Fume Toxicity Limit for Benzene

In the 2002 Local Limits study, fume toxicity levels were evaluated based on 29 CFR 1900 ceiling concentrations and the American Conference of Governmental Industrial Hygienists time weighted averages. These ceiling concentrations are the vapor phase concentrations of volatile organic compounds to which nearly all workers may be repeatedly exposed, over an eight-hour workday and a 40-hour work week, without adverse affect. The results indicated that benzene was a primary pollutant of concern based on fume toxicity at Rio de Flag WRP, with a screening level of 0.35 mg/L.

The recommendations and action plans for benzene are:

- Do not set local limit based on effluent criteria.
- Implement fume toxicity screening level of 0.35 mg/L.
- Continue on-going pretreatment program monitoring.

Best Management Practices for BEHP

BMPs are defined in the 2004 USEPA guidance manual [3] as "methods that have been determined to be the most effective and practical means of preventing or reducing pollution. The ultimate goal of these practices is to increase efficiency while reducing pollution". In some cases, BMPs have been incorporated into pollution prevention programs, which are designed to facilitate pollution prevention concepts and principles into the daily operations of government agencies, businesses, manufacturers, nonprofit organizations, and individuals.

The prevalence of BEHP in the environment results primarily from its use as a plasticizer in producing polyvinyl chloride (PVC) and thermoplastics. BEHP improves the workability of plastic products during the manufacturing process as well as the ultimate flexibility and toughness of these products. It is used in a wide array of industrial, commercial and consumer products, including medical devices, pesticide carriers, insect repellants, munitions, industrial oils and fluids, brake pads, tires, packing peanuts, cosmetics and fragrances [13, 14]

The only SIU with significant BEHP discharges was Mission Linen, which is a commercial laundry. Information presented at the Industrial Launderer web site [15] suggested that possible sources of BEHP in commercial or industrial laundries include:

- Soil on incoming textiles
- Wash and wastewater chemicals
- Plastic pipes and flexible tubing
- Mats or other textile items with rubber
- Miscellaneous chemicals.

The City should consider initiating a cooperative pollution prevention program with this SIU to prevent BEHP from entering the wastewater stream. This program could include the investigation of sources containing BEHP via products inventory and internal streams sampling and identification of BEHP-free products, among others.

The recommendations and action plans for BEHP are:

- Do not set a local limits based on effluent criteria.
- Implement other control measures such as best management practices

6.4.3 Do Not Set Local Limit

The application of the decision matrix provided the basis for not establishing local limits for antimony and selenium. These two pollutants do not pose a risk of pollutant pass-through or interference problems at the WWTPs. Antimony was not detected at any SIU sample or at the influent or effluent of either Wildcat Hill WWTP or Rio de Flag WRP. The selenium annual average influent loading to MAHL ratios for Wildcat Hill WWTP and Rio de Flag WRP were lower than 60 percent, and the effluent results were detected below the RLs, indicating a very low potential for pass-through. The current analyses using additional data confirm this previous conclusion.

The recommendation for the two pollutants in this group is:

- Do not set a local limits based on effluent criteria.
- Continue categorical IU monitoring, as applicable.

The 2002 Local Limits study recommended removing the chromium local limit of 0.9 mg/L and calculating the removal efficiencies for the Wildcat Hill WWTP and Rio de Flag WRP. The site specific removal efficiencies calculated based on the 2004-2005 sampling results are similar to the literature values used in the 2002 study, confirming the final recommendation of removing the local limits.

The recommendations and action plans for chromium are:

- Continue on-going pretreatment program monitoring.

Table 6.2 - 2009 Background Loading Calculation for Wildcat Hill WWTP										
Sources	Domestic		Commercial		NHLW		Rio de Flag WRP		Total Background	
2009 Flows (gpd)	3,130,980		957,682		4,409		89,757		4,182,828	
Pollutant	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)
Metals										
Antimony	0	0	0	0	0.010	0.00037	0	0	0.000011	0.00037
Copper	0.069	1.79	0.083	0.66	2.9	0.107	0.48	0.36	0.084	2.9
Cyanide (Total)	0	0	0	0	0.0075	0.00028	0	0	0.000008	0.00028
Lead	0.0013	0.035	0.0020	0.016	0.099	0.0036	0.024	0.018	0.0021	0.073
Mercury	0.000062	0.0016	0	-	0.012	0.00045	0.00097	0.00073	0.00008	0.0028
Selenium	0.0012	0.031	0.0014	0.011	0.028	0.00101	0	0	0.0012	0.043
Silver	0	0	0	0	0.0061	0.00022	0.056	0.042	0.0012	0.042
Volatile Organic Compounds										
Benzene	0.00031	0.0082	0	0	0.0033	0.00012	0	0	0.00024	0.0083
Semivolatile Organic Compounds										
BEHP	0.023	0.60	0.121	0.96	0.180	0.0066	0.019	0.014	0.045	1.58

Notes:
NHLW = Non-Hazardous Liquid Waste
NA = Not Analyzed

Table 6.3 - 2009 Background Loading Calculation for Rio de Flag WRP						
Sources	Domestic		Commercial		Total Background	
2009 Flows (gpd)	983,763		949,619		1,933,382	
Pollutant	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)	Conc. (mg/L)	Loading (lb/day)
Metals						
Antimony	0	0	0	0	-	0
Copper	0.069	0.56	0.083	0.66	0.076	1.22
Cyanide (Total)	0	0	0	0	0	0
Lead	0.0013	0.011	0.0020	0.016	0.0017	0.027
Mercury	0.000062	0.00050	0	0	0.000031	0.00050
Selenium	0.0012	0.010	0.0014	0.011	0.0013	0.021
Silver	0	0	0	0	0	0
Volatile Organic Compounds						
Benzene	0.00031	0.0026	0	0	0.00016	0.0026
Semivolatile Organic Compounds						
BEHP	0.023	0.189	0.121	0.955	0.071	1.144

Notes:
NHLW = Non-Hazardous Liquid Waste
NA = Not Analyzed

Table 6.5 - UCL Calculation for Wildcat Hill WWTP (with Trickling Filters) with Safety Factor of 10%							
Pollutants of Concern	**Safety Factor**	**UCL Calculation**					**Current Local Limits (mg/L)**
		MAHL (lb/day)	**BL (lb/day)**	**SA (lb/day)**	**AIL [1] (lb/day)**	**UCL [2] (mg/L)**	
Metals							
Antimony	10%	0.35	0.00037	0.035	0.31	0.14	No limit
Copper (AZPDES Interim Limit)	10%	6.41	2.92	0.64	2.85	1.31	1.0
Copper (AZPDES Final Limit)	10%	3.33	2.92	0.33	0.08	0.038	1.0
Cyanide (Total)	10%	0.72	0.00028	0.07	0.65	0.30	0.24
Lead	10%	1.05	0.073	0.11	0.88	0.40	0.98
Mercury	10%	0.046	0.0028	0.005	0.0389	0.0179	0.030
Selenium	10%	0.10	0.043	0.010	0.045	0.021	No limit
Silver	10%	0.81	0.042	0.081	0.69	0.32	0.72
Volatile Organic Compounds							
Benzene	10%	0.74	0.008	0.07	0.66	0.30	Prohibit
Semivolatile Organic Compounds							
BEHP	10%	2.02	1.58	0.20	0.23	0.11	No limit

Notes:

(1) AIL = MAHL - BL - SA

(2) UCL = AIL / 2009 Industrial Flow / 8.34

MAHL = Maximum allowable headworks loading

BL = Background loading

SA = Safety allowance

AIL = Allowable industrial loading

UCL = Uniform concentration limit

Table 6.6 - UCL Calculation for Wildcat Hill WWTP (with Activated Sludge) with Safety Factor of 10%							
Pollutants of Concern	**Safety Factor**	**UCL Calculation**					**Current Local Limits (mg/L)**
		MAHL (lb/day)	**BL (lb/day)**	**SA (lb/day)**	**AIL [1] (lb/day)**	**UCL [2] (mg/L)**	
Metals							
Antimony	10%	0.35	0.00037	0.035	0.31	0.14	No limit
Copper (AZPDES Interim Limit)	10%	11.66	2.92	1.17	7.57	3.49	1.0
Copper (AZPDES Final Limit)	10%	6.06	2.92	0.61	2.54	1.17	1.0
Cyanide (Total)	10%	0.96	0.00028	0.10	0.86	0.40	0.24
Lead	10%	0.38	0.073	0.04	0.27	0.13	0.98
Mercury	10%	0.02	0.0028	0.002	0.01	0.0064	0.030
Selenium	10%	0.15	0.043	0.01	0.09	0.041	No limit
Silver	10%	1.48	0.042	0.15	1.29	0.60	0.72
Volatile Organic Compounds							
Benzene	10%	0.93	0.008	0.09	0.83	0.38	Prohibit
Semivolatile Organic Compounds							
BEHP	10%	5.56	1.58	0.56	3.42	1.58	No limit

Notes:

(1) AIL = MAHL - BL - SA

(2) UCL = AIL / 2009 Industrial Flow / 8.34

MAHL = Maximum allowable headworks loading

BL = Background loading

SA = Safety allowance

AIL = Allowable industrial loading

UCL = Uniform concentration limit

Table 6.7 - UCL Calculation for Rio de Flag WRP with Safety Factor of 10%							
Pollutants of Concern	**Safety Factor**	**UCL Calculation**					**Current Local Limits (mg/L)**
		MAHL (lb/day)	**BL (lb/day)**	**SA (lb/day)**	**AIL [1] (lb/day)**	**UCL [2] (mg/L)**	
Metals							
Antimony	10%	0.21	0	0.021	0.19	0.031	No limit
Copper	10%	3.61	1.22	0.36	2.03	0.34	1.00
Cyanide (Total)	10%	0.57	0	0.057	0.51	0.086	0.240
Lead	10%	0.32	0.027	0.032	0.26	0.044	0.98
Mercury	10%	0.011	0.00050	0.0011	0.01	0.0016	0.03
Selenium	10%	0.088	0.021	0.009	0.06	0.0099	No limit
Silver	10%	5.52	0	0.55	4.96	0.84	0.72
Volatile Organic Compounds							
Benzene	10%	0.55	0.0026	0.055	0.49	0.083	Prohibit
Semivolatile Organic Compounds							
BEHP	10%	3.31	1.14	0.33	1.83	0.31	No limit

Notes:

(1) AIL = MAHL - BL - SA

(2) UCL = AIL / 2009 Industrial Flow / 8.34

MAHL = Maximum allowable headworks loading

BL = Background loading

SA = Safety allowance

AIL = Allowable industrial loading

UCL = Uniform concentration limit

Table 6.8 - UCL Calculation for Wildcat Hill WWTP (with Trickling Filters) with Safety Factor of 15%							
Pollutants of Concern	**Safety Factor**	**UCL Calculation**					**Current Local Limits (mg/L)**
		MAHL (lb/day)	**BL (lb/day)**	**SA (lb/day)**	**AIL [1] (lb/day)**	**UCL [2] (mg/L)**	
Metals							
Antimony	15%	0.35	0.00037	0.052	0.29	0.14	No limit
Copper (AZPDES Interim Limit)	15%	6.41	2.92	0.96	2.53	1.17	1.0
Copper (AZPDES Final Limit)	15%	3.21	2.92	0.48	-0.19	-0.088	1.0
Cyanide (Total)	15%	0.72	0.00028	0.11	0.61	0.28	0.24
Lead	15%	1.05	0.073	0.16	0.82	0.38	0.98
Mercury	15%	0.046	0.0028	0.007	0.0366	0.017	0.030
Selenium	15%	0.10	0.043	0.01	0.041	0.019	No limit
Silver	15%	0.81	0.042	0.12	0.64	0.30	0.72
Volatile Organic Compounds							
Benzene	15%	0.74	0.008	0.11	0.62	0.29	Prohibit
Semivolatile Organic Compounds							
BEHP	15%	2.02	1.58	0.30	0.13	0.062	No limit

Notes:

(1) AIL = MAHL - BL - SA

(2) UCL = AIL / 2009 Industrial Flow / 8.34

MAHL = Maximum allowable headworks loading

BL = Background loading

SA = Safety allowance

AIL = Allowable industrial loading

UCL = Uniform concentration limit

Table 6.9 - UCL Calculation for Wildcat Hill WWTP (with Activated Sludge) with Safety Factor of 15%							
Pollutants of Concern	**Safety Factor**	**UCL Calculation**					**Current Local Limits (mg/L)**
		MAHL (lb/day)	**BL (lb/day)**	**SA (lb/day)**	**AIL [1] (lb/day)**	**UCL [2] (mg/L)**	
Metals							
Antimony	15%	0.35	0.00037	0.052	0.29	0.14	No limit
Copper (AZPDES Interim Limit)	15%	11.66	2.92	1.75	6.99	3.22	1.0
Copper (AZPDES Final Limit)	15%	6.06	2.92	0.91	2.23	1.03	1.0
Cyanide (Total)	15%	0.96	0.00028	0.14	0.81	0.37	0.24
Lead	15%	0.38	0.073	0.06	0.25	0.12	0.98
Mercury	15%	0.02	0.0028	0.003	0.01	0.0060	0.030
Selenium	15%	0.15	0.043	0.02	0.08	0.038	No limit
Silver	15%	1.48	0.042	0.22	1.22	0.56	0.72
Volatile Organic Compounds							
Benzene	15%	0.93	0.008	0.14	0.78	0.36	Prohibit
Semivolatile Organic Compounds							
BEHP	15%	5.56	1.58	0.83	3.14	1.45	No limit

Notes:

(1) AIL = MAHL - BL - SA

(2) UCL = AIL / 2009 Industrial Flow / 8.34

MAHL = Maximum allowable headworks loading

BL = Background loading

SA = Safety allowance

AIL = Allowable industrial loading

UCL = Uniform concentration limit

Table 6.10 - UCL Calculation for Rio de Flag WRP with Safety Factor of 15%							
Pollutants of Concern	**Safety Factor**	**UCL Calculation**					**Current Local Limits (mg/L)**
		MAHL (lb/day)	**BL (lb/day)**	**SA (lb/day)**	**AIL [1] (lb/day)**	**UCL [2] (mg/L)**	
Metals							
Antimony	15%	0.21	0	0.031	0.18	0.030	No limit
Copper	15%	3.61	1.22	0.54	1.85	0.31	1.00
Cyanide (Total)	15%	0.57	0	0.085	0.48	0.081	0.240
Lead	15%	0.32	0.027	0.048	0.24	0.041	0.98
Mercury	15%	0.011	0.00050	0.0017	0.01	0.0015	0.03
Selenium	15%	0.088	0.021	0.013	0.05	0.0091	No limit
Silver	15%	5.52	0	0.83	4.69	0.79	0.72
Volatile Organic Compounds							
Benzene	15%	0.55	0.0026	0.083	0.47	0.079	Prohibit
Semivolatile Organic Compounds							
BEHP	15%	3.31	1.14	0.50	1.67	0.28	No limit

Notes:

(1) AIL = MAHL - BL - SA

(2) UCL = AIL / 2009 Industrial Flow / 8.34

MAHL = Maximum allowable headworks loading

BL = Background loading

SA = Safety allowance

AIL = Allowable industrial loading

UCL = Uniform concentration limit

Table 6.13 - Decision Matrix Results									
Criteria	**Pollutants of Concern**								
	Average Influent / MAHL between 0% and 60%							**Ave. Influent/ MAHL>60%**	
	Benzene	**Antimony**	**Silver**	**Cyanide**	**Lead**	**Selenium**	**Mercury**	**Copper**	**BEHP**
1. Critical Factors									
Does the pollutant have an existing local limit?	Prohibit	No	Yes	Yes	Yes	No	Yes	Yes	No
Has the Wildcat Hill WWTP had a pollutant effluent violation or exceedance in the last five years?	No	No	No	No	No	No	No	Yes	Yes
Has the Rio de Flag WRP had a pollutant effluent violation or exceedance in the last five years?	No	No	No	No	No	No	No	No	No
Was pollutant detected in most of effluent samples from either plant?	No	No	No	No	Yes	No	No	Yes	Yes
Average Influent loading to MAHL for Wildcat Hill WWTP?	2%	5%	9%	22%	14%	24%	42%	86%	90%
Average Influent loading to MAHL for Rio de Flag WRP?	2%	0%	1%	14%	15%	45%	15%	26%	34%
Daily Maximum Influent loading to MAHL for Wildcat Hill WWTP?	2%	5%	18%	22%	28%	45%	80%	203%	131%
Daily Maximum Influent loading to MAHL for Rio de Flag WRP?	2%	0%	2%	14%	25%	45%	15%	35%	51%
2. SIU Pollutant Discharges Comparison									
Are most SIU concentrations greater than background?	No [1]	No [1]	Yes	Yes	Yes	Yes	Yes	Yes	No
Are the calculated UCLs greater than background concentrations?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes [2]	Yes [3]
Are the calculated UCLs lower than any of the SIU pollutant discharges?	No	No	No	No	Yes	No	Yes	Yes	Yes
Are the calculated UCLs lower that current local limits?	NA	NA	Yes	Yes	Yes	NA	Yes	Yes [2]	NA
Are there any extenuating circumstances (i.e., large background sources, not representative background concentrations)	No	No	No	No	No	No	No	Yes	Yes
3. Common Sense Test									
Are limits technologically achievable?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Can the WWTPs and dischargers determine compliance with the limits (i.e., reporting limits are lower than local limits)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Are the limits sensible based on actual conditions at the WWTPs and experiences?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
4. Recommendation									
Maintain existing limit.				√				√	
Update local limit.			√		√		√		
Do not set limit. Local limit is not necessary.	√	√				√			
Consider loading reduction program or BMP implementation.								√	√

Notes:

(1) SIU discharges of benzene and antimony were not detected above the reporting limit.

(2) Most stringent UCL of 0.41 (based on AZPDES permit limitation for Rio de Flag WRP) was used for this comparison.

(3) Most stringent UCL of 0.37 mg/L (based on AWQS for Rio de Flag WRP) was used for this comparison.

7.1 GENERAL

The City uses an integrated strategy to control BOD_5 and TSS discharges to the sewer collection and treatment system. The strategy includes the following elements:

- Sufficient treatment capacity at the Wildcat Hill WWTP and Rio de Flag WRP to reduce influent loadings of $CBOD_5$, BOD_5, and TSS to the AZPDES permit limitations shown in Table 7.1. The permits also require 85 percent minimum removal for both $CBOD_5$ and TSS.
- An industrial discharge control program, including surcharges and concentration and mass local limits, to prevent discharge of excessive concentrations and loadings of BOD_5 and TSS to the plants. The current interim local limits are 1,000 mg/L for BOD_5 and 1,200 mg/L for TSS. Permits for four of the City's SIUs include mass limits. Violations of local limits are penalized by fines.
- An active commercial discharge control program to limit introduction of fats, oils, and grease (FOG) into the wastewater collection system. FOG can contribute high BOD_5 concentrations and loadings to the plants.

Table 7.1 - AZPDES Permit Limits

Effluent Characteristic	Average Monthly	Average Weekly
Wildcat Hill WWTP		
Concentration (mg/L)		
$CBOD_5$	25	40
TSS	30	45
Load (kg/d)		
$CBOD_5$	568	908
TSS	681	1022
Rio de Flag WRP		
Concentration (mg/L)		
BOD_5	30	45
TSS	30	45
Load (kg/d)		
BOD_5	454	681
TSS	454	681

Recently, the City and the SIUs have made progress in reducing industrial discharges and avoiding local limits exceedances by implementing the following changes in the pretreatment program:

- The City now calculates surcharges monthly, instead of annually, giving SIUs an opportunity to fine-tune pretreatment regularly to achieve best performance.

- SIUs have instituted BMPs aimed at reducing the quantity of high-strength wastes reaching the wastewater collection system, such as dry sweeping prior to wash down of manufacturing areas.
- SIUs have enhanced the operation of their pretreatment facilities, improving the quality of the pretreated wastewater discharged to the wastewater collection system.

The overall strategy works well, and the City is planning to continue using a combination of controls, including surcharges, local limits, and BMPs, to regulate industrial discharges of BOD_5 and TSS.

This section presents an overview of data collected from 2003 to 2005 for BOD_5 and TSS and a loading evaluation for the Wildcat Hill WWTP and Rio de Flag WRP. The objective of the BOD_5 and TSS loading evaluation was to determine the pollutant loading contributions from the domestic and NIND sectors, NHLW, Rio de Flag WRP sludge discharges, and industrial sector. This determination was the basis for comparing the current BOD_5 and TSS influent loadings to the current and proposed design capacity of Wildcat Hill WWTP and the current design capacity of the Rio de Flag WRP. Because the current interim BOD_5 and TSS local limits will remain effective until the Wildcat Hill WWTP upgrade is operational, this evaluation does not include an update of these limits.

7.2 METHODOLOGY

The analytical data and RLs were evaluated for the following locations:

- Domestic manholes: Cheshire and University
- Mixed commercial/domestic manhole: Railhead
- NHLW
- SIUs
- Rio de Flag WRP influent, effluent, and sludge
- Wildcat Hill WWTP influent and effluent

Mean concentrations were calculated using the detected results and data substitutions, when necessary, as described in Section 3.

7.3 BACKGROUND SOURCES

7.3.1 Domestic and NIND Sectors

The following locations and sampling data were used for the characterization of the domestic and NIND contributions to the Wildcat Hill WWTP and the Rio de Flag WRP:

- Cheshire and University domestic manholes sampled from October 1 through October 7, 2003.
- Railhead mixed commercial/domestic manhole sampled from October 2 through October 8, 2003.

Table 7.2 presents the mean, minimum, and maximum values for each sampling location.

Table 7.2 - BOD_5 and TSS Background Concentrations (mg/L)

Location	BOD_5			TSS		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Domestic Sector						
Cheshire	309	230	420	230	140	350
University	277	210	380	224	170	300
Average	293	-	-	227	-	-
NIND Sector						
Railhead	1,083	480	1,800	390	150	670
NHLW						
NHLW Discharges	6,100	2,600	11,000	14,000	5,800	31,000
Rio de Flag WRP Sludge						
Sludge Discharges	1,600	920	2,300	2,400	1,500	3,200

Table 7.2 shows that the mean BOD_5 concentration observed at the Railhead manhole location was more than three times greater than the mean concentrations measured at the domestic manholes. The mean TSS concentration at the Railhead manhole was approximately 70 percent greater than the mean domestic concentrations. In previous local limits studies in Flagstaff, samples were collected only at the Cheshire domestic manhole, so there is no basis for comparison. In other local limits studies, such as the 2004 SROG local limits study [5], domestic and NIND concentrations of these conventional parameters have been equivalent (e.g., 224 mg/L domestic vs. 253 mg/L NIND for BOD_5 and 233 mg/L domestic vs. 193 mg/L NIND for TSS).

City staff indicated that commercial garbage grinders are suspected of being a source of high BOD_5 and TSS in certain areas of the City, including the Railhead service area. The City is planning an initiative to educate users about reducing these loadings. It is recommended that the City conduct sampling at the Railhead manhole or at a similar mixed commercial/domestic location to characterize the loadings from the NIND sector with garbage grinders before and after the initiative. If the initiative does not reduce loadings, then the City may want to consider modifying its ordinance to ban the use of commercial garbage grinders.

7.3.2 NHLW

NHLW currently accepted for treatment at the Wildcat Hill WWTP consists of wastes from residential septic tanks and portable toilets. The average concentrations of BOD_5 and TSS in NHLW were based on the mean of sampling results collected during the sampling event conducted in October 2003. Results are summarized in Table 7.2 above.

7.3.3 Rio de Flag WRP Sludge

The average concentrations of BOD_5 and TSS in the Rio de Flag WRP sludge were based on the mean of sampling results collected during the sampling event conducted in November 2003. Results are summarized in Table 7.2 above.

7.4 SIGNIFICANT INDUSTRIAL USERS

Wastewater samples were collected from these SIUs between January 2004 and August 2005. The mean, minimum, and maximum concentrations of BOD_5 and TSS from the SIUs are summarized in Table 7.3.

Over the period of record, a majority of the SIUs discharged BOD_5 and TSS concentrations in the range typical of the discharges observed at the Railhead mixed commercial/domestic sampling location (i.e., 480 to 1800 mg/L BOD_5 and 150 to 670 mg/L TSS). Exceptions were as follows:

- Joy Cone discharged BOD_5 concentrations ranging from 360 to 27,000 mg/L, with a mean of 9,600 mg/L (based on 131 samples). TSS concentrations varied from 13 to 1,400 mg/L, with a mean of 189 mg/L (based on 132 samples).
- SCA Tissue discharged TSS concentrations ranging from 6 to 2,000 mg/L, with a mean of 344 mg/L (based on 115 samples).
- Mission Linen & Uniform (Huntington Drive) discharged TSS concentrations ranging from 140 to 1,100 mg/L, with a mean of 361 mg/L (based on 18 samples).
- Nestle Purina discharged BOD_5 concentrations ranging from 360 to 11,000 mg/L, with a mean of 2,100 mg/L (based on 49 samples). TSS concentrations varied from 47 to 3,900 mg/L, with a mean of 980 mg/L (based on 49 samples).
- Pepsi Cola discharged BOD_5 concentrations ranging from 22 to 2,200 mg/L, with a mean of 1,200 mg/L (based on 24 samples). TSS concentrations varied from 94 to 1,300 mg/L, with a mean of 570 mg/L (based on 24 samples).

7.5 WASTEWATER TREATMENT PLANTS

Influent and effluent concentration data for BOD_5 and TSS were reviewed to characterize the levels measured at the Wildcat Hill WWTP and Rio de Flag WRP. In addition, the number of samples collected, number of detected results (e.g., concentration results above the RLs), and average concentration were used to assess the quality of the data set. A

summary of the mean, minimum, and maximum concentrations is presented in Table 7.4.

Table 7.4 - BOD_5 and TSS WWTP Concentrations (mg/L)						
Location	BOD_5			TSS		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Wildcat Hill WWTP						
Influent	423	360	430	411	360	480
Effluent	9	7	13	<10	-	-
Rio de Flag WRP						
Influent	260	200	300	239	200	300
Effluent	<5	-	-	<5	-	-

The average influent and effluent BOD_5 and TSS concentrations for the Wildcat Hill WWTP were estimated based on the mean of seven sampling results collected during the sampling event conducted in October 2003. TSS concentrations were below the detection level in all effluent samples collected at the Wildcat Hill WWTP. The average influent and effluent concentrations for the Rio de Flag WRP were estimated based on the mean of seven sampling results collected during the sampling event conducted in November 2003. BOD_5 and TSS concentrations were below the detection level in all effluent samples collected at the Rio de Flag WRP.

7.6 WASTEWATER LOADINGS

The following sections describe the calculation of the loadings for each sector discharging to both treatment plants. These calculations were conducted using the 2003 annual flows (calculated using the methodology described in Section 4) and the average concentrations for BOD_5 and TSS. Tables 7.5 and 7.6 summarize background loadings, SIU loadings, and influent loadings for the Wildcat Hill WWTP and the Rio de Flag WRP.

7.6.1 Background Loadings

The 2003 pollutant loadings for each background location were calculated by multiplying the average concentrations for BOD_5 and TSS by the corresponding average flows. Tables 7.5 and 7.6 present the loading calculation for the background sources discharging to the Wildcat Hill WWTP and Rio de Flag WRP.

7.6.2 SIU Loadings

The 2003 pollutant loadings for the SIUs were calculated by multiplying the average concentrations for BOD_5 and TSS by the corresponding average flows. Tables 7.5 and 7.6 present the loading calculation for the SIUs discharging to the Wildcat Hill WWTP and Rio de Flag WRP.

7.6.3 Influent Loadings

The 2003 pollutant loadings for the influent of the Wildcat Hill WWTP and Rio de Flag WRP were calculated by multiplying the average concentrations for BOD_5 and TSS by the corresponding average influent flows, as presented in Tables 7.5 and 7.6.

7.7 INFLUENT MASS BALANCES

For each plant, the sum of the background and industrial loadings was compared to the observed influent loading to determine if the pollutant loadings from individual sources have been identified. In general, a closure of 80% to 120% is desirable (i.e., the calculated service area loading should be within +/- 20% of the observed influent loading).

Wildcat Hill WWTP

For BOD_5 and TSS, reasonable mass balance closures of 114% and 79% were obtained.

Rio de Flag WRP

- For BOD_5, the calculated loading was much greater than the plant's estimated influent loading (239%).
- For TSS, a reasonable mass balance closure of 116% was obtained.

As discussed previously, the NIND sampling results for BOD_5 were much higher than domestic results, as opposed to other municipal studies in which domestic and NIND concentrations have been similar. The BOD_5 mass balance results suggest that the sampling results obtained at the Railhead manhole and used to characterize the NIND contributions may not be a good representation of typical NIND discharges in the Rio de Flag WRP service area.

In addition, an expansion of the mall in the Railhead service area will be complete in three years, and when complete, the outfall from the mall will no longer discharge to the Railhead manhole. In anticipation of this event, it is recommended that the City identify one or more alternate mixed commercial/domestic sampling locations, including, if possible, a location in the Rio de Flag WRP service area, that do not receive flow from any SIUs.

7.8 COMPARISON OF INFLUENT AND DESIGN LOADINGS

The 2004 USEPA guidance manual [3] recommends that the average design capacity of the WWTP for a conventional pollutant (such as BOD_5 or TSS) be used as the monthly average MAHL, and the peak loading capacity used as the daily maximum MAHL, in understanding the degree to which the plant is loaded. Although it sets no firm

requirements for establishing local limits for conventional pollutants, The USEPA guidance manual mentions that some EPA regions require plants that operate at 80 percent of their MAHLs for three months of the calendar year to develop local limits. This evaluation used the 80 percent level to assess the effectiveness of the City's control strategy for BOD_5 and TSS.

For each plant, the influent BOD_5 and TSS loadings were compared to design values. The loadings were based on concentration data collected over a short sampling period (i.e., seven days in October, 2003), and therefore may not be representative of actual annual average conditions. Table 7.8 summarizes the results of these analyses.

Table 7.8 - Comparison of Influent and Design BOD_5 and TSS Concentrations and Loadings

Parameter	Estimated 2003 (1)	Existing Design Criteria (2)	Estimated 2003 / Existing Design Criteria	Proposed Design Criteria (3)	Estimated 2003 / Proposed Design Criteria
Wildcat Hill WWTP					
Flow, mgd	3.88	6	65%	6	65%
BOD_5 Concentration, mg/L	423	216	-	443	-
BOD_5 Load, lb/d	13,688	10,800	127%	22,200	62%
TSS Concentration, mg/L	411	216	-	574	-
TSS Load, lb/d	13,300	10,800	123%	28,700	46%
Rio de Flag WRP					
Flow, mgd	1.99	4	50%	6	33%
BOD_5 Concentration, mg/L	260	281	-	-	-
BOD_5 Load, lb/d	4,315	9,370	46%	-	-
TSS Concentration, mg/L	239	221	-	-	-
TSS Load, lb/d	3,967	7,370	54%	-	-

Notes:
(1) Flow and concentration estimates based on sampling conducted in 2003.
(2) From City of Flagstaff Study and Re-evaluation of City's Pretreatment Local Limits, Final Report, Malcolm Pirnie, Inc. June 2002.
(3) From City of Flagstaff Wastewater Plant Improvements Basis of Design Report, Black and Veatch. October 19, 2004.

Table 7.8 shows that the influent BOD_5 and TSS loadings to Wildcat Hill WWTP exceed current design criteria, although current flows are only 65 percent of design flows. In 2004, the City re-evaluated the basis of design for the Wildcat Hill WWTP (as discussed in Section 2.2), resulting in the proposed design criteria shown in Table 7.8. Based on

information provided by City staff, the conversion to the activated sludge processes that will support the proposed increases in design loadings is planned to be completed and operational by mid-2007. The current BOD_5 and TSS loadings represent 62 and 46 percent of the proposed design loadings. These loadings are well below the 80 percent threshold that might trigger the need for more stringent controls.

Table 7.8 shows that the influent BOD_5 and TSS loadings to Rio de Flag WWTP are well within existing design criteria, with current flows averaging 50 percent of design flow, and current BOD_5 and TSS loadings averaging 46 and 54 percent of design loadings. These loadings are well below the 80 percent threshold.

7.9 SUMMARY

The City's pretreatment program strategy, consisting of surcharges, local limits, and BMPs, is effective in controlling industrial discharges of BOD_5 and TSS to the Wildcat Hill WWTP and Rio de Flag WRP. Recent changes to the program have improved SIU pretreatment performance and reduced the incidence of local limits exceedances.

Domestic and NIND contributions of BOD_5 and TSS make up the highest proportion of the influent loading to the Wildcat Hill WWTP and Rio de Flag WRP. The results of this evaluation suggested that discharges from the NIND sector may not be well characterized. It is recommended that the City investigate the potential sources of high BOD_5 concentrations in the Railhead mixed domestic/commercial manhole. An expansion of the mall in the Railhead service area will be complete in three years, and when complete, the outfall from the mall will no longer discharge to the Railhead manhole. In anticipation of this event, it is recommended that the City identify one or more alternate mixed commercial/domestic sampling locations, including, if possible, a location in the Rio de Flag WRP service area, that do not receive flow from any SIUs.

City staff indicated that commercial garbage grinders are suspected of being a source of high BOD_5 and TSS in certain areas of the City, including the Railhead service area. The City is planning an initiative to educate users to reduce these loadings. It is recommended that the City conduct sampling at the Railhead manhole or at a similar mixed commercial/domestic location to characterize the loadings from NIND users with garbage grinders before and after the initiative. If the initiative does not reduce loadings, then the City may want to consider modifying its pretreatment ordinance to ban the use of commercial garbage grinders.

Although the 2003 influent BOD_5 and TSS loadings to Wildcat Hill WWTP exceed existing design capacities, the City's planned improvements to the Wildcat Hill WWTP, will significantly increase design capacities. The current influent BOD_5 and TSS loadings

to the Wildcat Hill WWTP are well within proposed design capacities, and the current loadings to the Rio de Flag WWTP are well within existing design capacities. More stringent controls are not required at this time. It is recommended that the City re-evaluate its current local limits for BOD_5 and TSS once the improvements at Wildcat Hill WWTP and Rio de Flag WRP are complete, and the flow split between the two plants has been normalized.

Table 7.3 - BOD_5 and TSS SIU Concentrations (mg/L)								
Location	BOD_5				TSS			
	# Samples	Mean	Minimum	Maximum	# Samples	Mean	Minimum	Maximum
SIUs Discharging to Wildcat Hill WWTP and Rio de Flag WRP								
NAU – Dome	5	293	25	416	5	144	96	220
NAU – Biology	6	28	9	63	6	32	3	72
NAU – Chemistry [1]	-	-	-	-	-	-	-	-
NAU – Biochemistry	5	368	248	518	5	169	68	230
Flagstaff Medical Center	6	239	150	390	6	179	56	438
W. L. Gore – Woody Mountain	2	119	68	170	2	166	82	250
W. L. Gore – Echo Ridge[2]	-	-	-	-	-	-	-	-
Joy Cone [3]	131	9,646	360	27,000	132	189	13	1,400
SIUs Discharging to Wildcat Hill WWTP Only								
SCA Tissue	113	128	12	760	115	344	6	2,000
Mission Linen & Uniform (Huntington Dr.)	25	817	33	1,500	18	361	140	1,100
Nestle Purina	49	2,070	362	10,770	49	983	47	3,850
Pepsi Cola Bottling Company	24	1,177	22	2,200	24	573	94	1,300
W. L. Gore – 4th Street		215	-	-		212	-	-

Notes:

(1) Outfall closed

(2) No BOD_5 or TSS data available

(3) Joy Cone only discharges to Rio de Flag WRP

Table 7.5 – Wastewater BOD_5 and TSS Average Loadings to Wildcat Hill WWTP				
Sectors	**BOD_5**		**TSS**	
	Concentration (mg/L)	**Loading (lb/d)**	**Concentration (mg/L)**	**Loading (lb/d)**
Background Sources				
Domestic	293	6,333	227	4,907
NIND	1,083	7,160	390	2,579
NHLW	6,133	187	14,183	432
Rio de Flag WRP Sludge	1,574	975	2,400	1,487
Total Background	508	14,656	326	9,404
SIUs				
NAU – Dome	293	155	144	76
NAU – Biology	28	3	32	3
NAU - Biochemistry	368	3	169	2
Flagstaff Medical Center	239	23	179	17
W.L. Gore – Woody Mountain	119	6	166	8
W.L. Gore – Echo Ridge	-	-	-	-
SCA Tissue	128	268	344	719
Mission Linen & Uniform	817	180	361	79
Nestle Purina	2,070	357	983	170
Pepsi Cola Bottling Company	1,177	114	573	55
W.L. Gore – 4th Street	215	19	212	19
Total SIUs	269	1130	335	1151
Sum of Total Background + SIUs		15,786		10,555
WWTP Influent	423	13,682	411	13,294
% Closure		115%		79%

Table 7.6 – Wastewater BOD_5 and TSS Average Loadings to Rio de Flag WRP				
Sectors	**BOD_5**		**TSS**	
	Concentration (mg/L)	**Loading (lb/d)**	**Concentration (mg/L)**	**Loading (lb/d)**
Background Sources				
Domestic	293	1,990	227	1,542
NIND	1,083	7,100	390	2,557
Total Background	633	9,090	297	4,099
SIUs				
NAU – Dome	293	620	144	305
NAU – Biology	28	11	32	13
NAU - Biochemistry	368	14	169	6
Flagstaff Medical Center	239	91	179	68
W.L. Gore – Woody Mountain	119	24	166	34
W.L. Gore – Echo Ridge	-	-	-	-
Joy Cone	9,646	475	189	9.3
Total SIUs	383	1,235	136	435
Sum of Total Background + SIUs		10,325		4,534
WWTP Influent	260	4,313	239	3,965
Closure		239%		114%

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 GENERAL

Thirteen pollutants were identified for performing loading calculations, and further analysis based on the additional sampling conducted in 2003 and taking into account the changes that have occurred since the 2002 local limits study (i.e., new AZPDES permits, changes in SIUs and collection system). AHL analyses were determined for nine POCs, resulting in a uniform set of local limits to protect the Wildcat Hill WWTP and Rio de Flag WRP. Influent mass balances for zinc and removal efficiency analysis for total chromium were performed to confirm the 2002 recommendations. BOD_5 and TSS were evaluated based on design loadings to the plants. The following table summarizes the general recommendations for the POCs:

Table 8.1 – Summary of Recommendations

Pollutant	Current Local Limit	Recommendations
Metals		
Antimony	No Limit	No Limit
Chromium (Total)	No Limit	No Limit
Cyanide (Total)	0.24 mg/L	0.24 mg/L
Copper	1.0 mg/L	1.0 mg/L and Background Loading Reduction Program
Lead	0.98 mg/L	0.041 mg/L
Mercury	0.030 mg/L	0.017 mg/L
Selenium	No Limit	No Limit
Silver	0.72 mg/L	0.30 mg/L
Zinc	1.4 mg/L	1.4 mg/L
Volatile Organic Compounds		
Benzene	Prohibited	0.35 mg/L
Semi Volatile Organic Compounds		
BEHP	No Limit	BMP
Conventional Pollutants		
BOD_5	1,000 mg/L	1,000 mg/L
TSS	1,200 mg/L	1,200 mg/L

Table 8.2 compiles the controlling criteria, recommended local limits, and proposed actions for the POCs. These recommendations and action plans are in addition to the 2002 Local Limits Study recommendations (Appendix F). Other pollutants, such as arsenic, also have local limits as documented in the 2002 study [1].

Table 8.2 - Proposed Actions					
POC	**Controlling Criteria**		**Current Local Limit (mg/L)**	**Recommended Local Limit (mg/L)**	**Proposed Actions**
	Source	**(mg/L)**			
Metals					
Antimony	AWQS	0.006	No Limit	No Limit	Do not set new local limit. Local limit based on effluent criteria is not necessary.
					Continue categorical IU monitoring, as applicable.
Chromium	APP	0.1	No Limit	No Limit	Site specific removal efficiencies based on the 2004-2005 sampling results were comparable to the removal efficiencies used in the 2002 study.
					Do not set a local limit. Local limit based on effluent criteria is not necessary.
					Continue categorical IU monitoring, as applicable.
Cyanide (total)	AZPDES	0.008	0.24	0.24	Maintain current local limit.
					Once the conversion to activated sludge at Wildcat Hill WWTP is completed, conduct sampling and re-evaluate removal efficiencies, MAHL, and UCL to assess if this plant is still protected by local limit.
					Continue ongoing pretreatment program monitoring.
Copper	AZPDES	0.018	1	0.28	Maintain current local limit.
					Implement copper reduction plan to reduce background copper contributions to the plants.
					Promote copper reduction BMPs and best available technologies for treatment at the SIUs.
					Once the background loading have been reduced and conversion to activated sludge at Wildcat Hill WWTP is completed, conduct sampling and re-evaluate background loadings, removal efficiencies, MAHL, and UCL at both plants and assure that the plant will comply with the AZPDES final limit of 0.018 mg/L (July 2008).

Table 8.2 - Proposed Actions (Cont.)					
POC	**Controlling Criteria**		**Current Local Limit (mg/L)**	**Recommended Local Limit (mg/L)**	**Proposed Actions**
	Source	**(mg/L)**			
Copper (Cont.)					Continue ongoing pretreatment program monitoring.
Lead	AZPDES	0.00432	0.98	0.041	Update current local limit using the most stringent UCL based on site-specific data. Most stringent UCL is based on Rio de Flag WRP AZPDES permit limitation.
					Once the conversion to activated sludge at Wildcat Hill WWTP is completed, conduct sampling and re-evaluate removal efficiencies, MAHL, and UCL to assess if this plant is still protected by local limit.
					Continue ongoing pretreatment program monitoring.
Mercury	AZPDES	0.0002	0.030	0.017	Update current local limit using the most stringent UCL based on site-specific data. Most stringent UCL is based on Wildcat Hill WWTP AZPDES permit limitation.
					Once the conversion to activated sludge at Wildcat Hill WWTP is completed, conduct sampling and re-evaluate removal efficiencies, MAHL, and UCL to assess if this plant is still protected by local limits.
					Continue ongoing pretreatment program monitoring.
Selenium	AZPDES	0.002	No Limit	No Limit	Do not set a local limit. Local limit based on effluent criteria is not necessary.
					Continue categorical IU monitoring, as applicable.

Table 8.2 - Proposed Actions (Cont.)					
POC	**Controlling Criteria**		**Current Local Limit (mg/L)**	**Recommended Local Limit (mg/L)**	**Proposed Actions**
	Source	**(mg/L)**			
Silver	AZPDES	0.0048	0.72	0.30	Update current local limit using the most stringent UCL. Most stringent UCL is based on Wildcat Hill WWTP AZPDES permit limitation.
					Once the conversion to activated sludge at Wildcat Hill WWTP is completed, conduct sampling and re-evaluate removal efficiencies, MAHL, and UCL to assess if this plant is still protected by local limits.
					Continue ongoing pretreatment program monitoring.
Zinc	NPDES	0.124	1.4	1.4	Influent mass balances results confirmed that that the zinc contributions from the sectors discharging to the Wildcat Hill WWTP and Rio de Flag WRP have been characterized.
					Maintain current local limit.
					Once the conversion to activated sludge at Wildcat Hill WWTP is completed, conduct sampling and re-evaluate removal efficiencies, MAHL, and UCL to assess if this plant is protected by local limits.
					Continue ongoing pretreatment program monitoring.
Volatile Organic Compounds					
Benzene	APP, AWQS	0.005	Prohibited	0.35 mg/L	Implement fume toxicity screening level.
					Local limit based on effluent criteria is not necessary.

Table 8.2 - Proposed Actions (Cont.)					
POC	**Controlling Criteria**		**Current Local Limit (mg/L)**	**Recommended Local Limit (mg/L)**	**Proposed Actions**
	Source	**(mg/L)**			
Semi Volatile Organic Compounds					
BEHP	AWQS	0.006	No Limit	No Limit	Do not set new local limit. The UCL of 0.062 mg/L is not technologically achievable.
					Initiate a cooperative BMP program with Mission Linen and other SIUs to prevent BEHP from entering the wastewater collection system.
Conventional Pollutants					
BOD_5	AZPDES	$CBOD_5$ of 25 mg/L at Wildcat Hill WWTP and BOD_5 of 30 mg/L at Rio de Flag WRP (as monthly average)	1,000 mg/L	1,000 mg/L	Continue using a combination of controls, including surcharges, local limits, and BMPs, to regulate industrial discharges of BOD_5.
					Investigate sources of high BOD_5 concentrations in the Railhead manhole.
					When the expansion of the mall in the Railhead service area is completed in three years, the outfall from the mall may no longer discharge to the Railhead manhole. Consider identifying one or more alternate mixed commercial/domestic sampling locations that do not receive flow from any SIUs.
					Re-evaluate current local limit once the improvements at Wildcat Hill WWTP and Rio de Flag WRP are complete, and the flow split between the plants has been normalized.

Table 8.2 - Proposed Actions (Cont.)					
POC	**Controlling Criteria**		**Current Local Limit (mg/L)**	**Recommended Local Limit (mg/L)**	**Proposed Actions**
	Source	**(mg/L)**			
Conventional Pollutants					
TSS	AZPDES	30 mg/L at Wildcat Hill WWTP and at Rio de Flag WRP (as monthly average)	1,200 mg/L	1,200 mg/L	Continue using a combination of controls, including surcharges, local limits, and BMPs, to regulate industrial discharges of TSS.
					When the expansion of the mall in the Railhead service area is completed in three years, the outfall from the mall may no longer discharge to the Railhead manhole. Consider identifying one or more alternate mixed commercial/domestic sampling locations that do not receive flow from any SIUs.
					Re-evaluate current local limit once the improvements at Wildcat Hill WWTP and Rio de Flag WRP are complete, and the flow split between the plants has been normalized.

8.2 FUTURE LIMITS REVIEWS AND DETAILED RE-EVALUATIONS

According to the 40 CFR 122.44(j)(2)(ii), POTWs must "provide a written evaluation of the need to revise local limits under 40 CFR 403.5(c)(1), following permit issuance or reissuance." As discussed in Chapter 7 of the 2004 USEPA guidance manual [3], EPA recommends that a periodic evaluation of local limits be tied to the permit cycle and more detailed evaluation be conducted on an "as needed" basis.

8.2.1 Reviews of Limits

The City current sampling frequency of the POCs on monthly and quarterly bases provides the necessary data to conduct annual local limits reviews as part of its preparation of the Annual Pretreatment Report. The goals of the reviews is to ensure that any changes made during the previous year have not weakened the local limits' effectiveness in protecting the plants from pass-though or interference [3]. The reviews may consist of comparison of current loadings to the MAHLs for each POC at each plant, regardless if a local limit has been set. The reviews also include a check of compliance with permit effluent and sludge limitations. The City may find further action is necessary after conducting reviews to

ensure the protection of the plants.

8.2.2 Detailed Re-Evaluation of Limits

As discussed in previous sections, changes will be occurring in the collection system and at the plants over the next few years and the AZPDES permit conditions will require compliance. A recent change in January 2006 of SCA Tissue discharging to the Rio de Flag WRP instead of Wildcat Hill WWTP was incorporated into the recommendations of local limits for this study. A summary of the planned system changes, permit requirements, and the impacts to the local limit analyses are summarized in Table 8.3.

Table 8.3 - Summary of Planned System Changes and Current Permit Requirements

Date	Description	Impact on Local Limits Analyses
Mid-summer 2007	Conversion of Wildcat Hill WWTP to activated sludge system and improvement in its effluent quality to Class A+ water	Recalculate Wildcat Hill WWTP removal efficiencies, MAHL, and limits for POCs.
Mid-summer 2007	Replacement of Rio de Flag WRP's dual-media filters with disk filters	Recalculate Rio de Flag WRP removal efficiencies, MAHL, and limits for POCs.
July 7, 2008	New copper limits in effect for Wildcat Hill WWTP. Copper reduction plan implemented.	After source reduction program implemented and conversion of Wildcat Hill WWTP, recalculate background loading, MAHL and local limit to both plants.
July 7 and July 26, 2009	Current AZPDES permits expire at both plants. New permits to be reissued.	If effluent limitations change in draft permits, recalculate MAHL for POCs. Perform local limits evaluation in accordance with the 40 CFR 122.44(j)(2)(ii).

Certain actions need to occur prior to the improvement changes at the plants. The following actions, which relate to the pollutants in which pass-through is a major concern at the treatment plants, (copper and BEHP) should be initiated immediately:

- Develop source identification and reduction plans for copper in accordance with the AZPDES permit and for BEHP.
- Inspect BMPs for the pollutants at the SIUs and commercial users.
- Consider best available technologies for treatment of copper at SIUs.
- Update the public education program of the pollutants of concern concentrating on these pollutants.
- Implement source reduction plans for copper and BEHP.

The City should begin planning for future limits reviews and re-evaluations of MAHLs and limits; by budgeting for necessary sampling. Routine POC sampling should continue. Additional sampling based on the changes outlined in the Table above and action plans in this study are discussed in more detail below.

8.2.3 Sampling Summary

Sampling at the Wildcat Hill WWTP (influent, effluent, and sludge to disposal), Rio de Flag WRP (influent, effluent, and sludge to the collection system), two domestic locations, two mixed domestic/commercial location, the SIUs are recommended for the pollutants of concern in varying degrees. Suggested sampling frequencies are recommended to obtain site-specific data for removal efficiencies, background concentrations, and SIU concentrations. Using the low detection limits for pollutants that are often not detected greatly increases the set of usable data and may eliminate the need to resample for specific pollutants.

This section provides a general overview of the necessary sampling for the next local limits update. The USEPA guidance manual [3] would provide additional direction and details regarding proper sampling techniques for local limits studies.

WWTP Sampling

The calculation of removal efficiencies at the treatment plants requires a minimum of seven paired detected influent and detected effluent data sets per USEPA guidance manual [3] for initial local limits studies. Increasing the number of data sets will correspondingly increase the confidence level of the removal efficiency calculations.

Samples can be collected as seven consecutive days; however, a yearlong sampling program would account for seasonal variations in the removal efficiencies. Therefore, sampling once per month, rotating days of the week each month is recommended. USEPA guidance manual [3] recommends flow-weighted 24-hour composite samples for the influent and effluent taking into account the hydraulic detention time through the plant.

A minimum of three sludge samples at Wildcat Hill WWTP and Rio de Flag WRP must be taken in the same sampling event as the influent and effluent samples to verify treatment plant mass balance and to estimate sludge removal efficiencies. More frequent sludge samples or taking into account solids retention time is not recommended by USEPA guidance manual [3] because of the variation in solids retention time and nature of the sludge sampling procedure itself.

Sampling of the Rio de Flag sludge is also performed for the background loadings calculations. For this location, sampling frequency should be the same as that for

background sampling locations.

Background Sampling

To estimate background loadings in the collection system, a minimum of seven consecutive days of sampling at two domestic locations, at two mixed domestic/commercial location, of the Rio de Flag WRP sludge, and of non-hazardous liquid waste are recommended. Two mixed commercial/residential location would provide source data that may improve the influent mass balance ratios for those pollutants that are known to come from commercial sources (e.g., silver and mercury).

Implementing a yearlong sampling program would account for seasonal variations in the background concentrations. Sampling two to three consecutive days, four times per year, rotating months and days of the week each quarter is recommended. Data collection over the one-year period would provide 8 to 12 results per pollutant and account for seasonal variability. USEPA guidance manual [3] recommends flow-weighted 24-hour composite samples for the background sampling.

Industrial Sampling

Industrial sampling data would provide source identification of pollutants of concern. Currently, quarterly samples are taken for pollutants with local limits. All POCs should be sampled at each industry at a minimum on the quarterly basis. Use of self-monitoring data from the SIUs should also be included in the industrial sampling database and used for the local limits update.

9.0 REFERENCES

1. City of Flagstaff Study and Re-evaluation of City's Pretreatment Local Limits, Final Report, Malcolm Pirnie, Inc. June 2002.

2. Wildcat Hill WWTP Development of Local Pretreatment Limits (Final Report) for the City of Flagstaff, Malcolm Pirnie, Inc. June 30, 1993.

3. Local Limits Development Guidance, U.S. Environmental Protection Agency. July 2004.

4. City of Flagstaff Wastewater Plant Improvements Basis of Design Report, Black and Veatch. October 19, 2004.

5. Final Report 2004 Local Limits Update for Sub Regional Operating Group (SROG), Malcolm Pirnie, Inc. May 2004.

6. Guidance Manual on the Development and Implementation of Local Discharge Limitations under the Pretreatment Program, U.S. Environmental Protection Agency, November 1987.

7. Flagstaff 2020 Community Visioning Project, June 1997.

8. Activated Sludge Manual of Practice OM-9, Water Environment Federation, 2002.

9. Biological and Chemical Systems for Nutrient Removal, Water Environment Federation, 1998.

10. Manual of Practice No. 8 Design of Municipal Wastewater Treatment Plants, Water Environment Federation, 1998

11. Risk Reduction Engineering Laboratory (RREL) Treatability Database Version 5, U.S. Environmental Protection Agency, 1992.

12. PRELIM Version 5.0, U.S. Environmental Protection Agency. June 1996.

13. Bis(2-Ethylhexyl) Phthalate Source Identification Study for the Los Angeles-Glendale Water Reclamation Plant, City of Los Angeles Department of Public Works Bureau of Sanitation Industrial Waste Management Division. June 1998.

14. Source Control Activities, June 2004 Progress Report, King County, Washington.

June 2004.

15. Industrial Launderer Website, Ask the Experts,: http://www.ilmagonline.com/members/dept.php?pub_id=96&name=ask_an_expert

A

Appendix A

Review of New AZPDES Permits in relation to Regulatory Criteria Used in 2002 Local Limits Study

Pollutant	Surface Water Quality Standards [1]			AZPDES Monthly Average [4]		AZPDES Daily Maximum [4]		NPDES Monthly Average [5]		NPDES Daily Maximum [5]		APP		Aquifer Water Quality Standards (6) (mg/L)	Most Stringent Criteria		Federal Sludge (mg/Kg)	State Sludge (mg/Kg)
	A & W edw [2] Acute (mg/L)	A & W edw [2] Chronic (mg/L)	PBC [3] (mg/L)	Wildcat Hill (mg/L)	Rio De Flag (mg/L)	Wildcat Hill (mg/L)	Rio De Flag (mg/L)	Wildcat Hill (mg/L)	Rio De Flag (mg/L)	Wildcat Hill (mg/L)	Rio De Flag (mg/L)	Wildcat Hill (mg/L)	Rio De Flag (mg/L)		Wildcat Hill (mg/L)	Rio De Flag (mg/L)		
-																		
Antimony			0.056											0.006	0.006	0.006		
Chromium												0.1	0.1	0.1	0.1	0.1		3000
Copper - New Limits								0.0147	0.0147	0.0224	0.0224						1500	1500
Copper - Interim Limits																		
Cyanide (total)	0.041	0.0097	2.8	0.008	0.008	0.016	0.016	0.0097	0.0097	0.041	0.041			0.2	0.008	0.008		
Lead				0.00393		0.00788	0.00867	0.004	0.004	0.103	0.103	0.05	0.05	0.05	0.00393		300	300
Mercury			0.042	0.0002	0.0002	0.0003	0.0003	0.0002	0.0002	0.0026	0.0026	0.002	0.002	0.002	0.0002	0.0002	17	17
Selenium	0.05	0.002	0.7	0.002	0.002	0.003	0.003	0.002	0.002	0.05	0.05	0.05	0.05	0.05	0.002	0.002	100	100
Silver				0.0048						0.0056	0.0056				0.0048			
Zinc			42	0.097				0.124	0.124	0.137	0.137				0.097		2800	2800

	More Stringent
	Less Stringent
	Remained the same

Notes:

(1) Arizona Administrative Code, Title 18, Chapter 11, Appendix A, September 1996

(2) Based on Effluent Dominated Water (EDW) Surface Water Quality Standards

(3) Based on Partial Body Contact (PBC) Surface Water Quality Standards

(4) AZPDES Permits AZ0020427 for Wildcat Hill WWTP expires on July 7, 2009 and AZ0023639 for Rio de Flag WRP expires on July 26, 2009.

(5) NPDES Permit for Wildcat Hill WWTP expired on November 1, 2004 and for Rio de Flag WRP expired in November 1, 2004.

(6) Arizona Administrative Code, Title 18, Chapter 11, Section 406, September 1996

Excerpt from the Wildcat Hill WWTP AZPDES Permit No. AZ0020427
Effective Date: July 7, 2005

"PART V. SPECIAL CONDITIONS

A. COMPLIANCE SCHEDULE

1. The City of Flagstaff shall develop and implement a plan to reduce the facility's effluent concentrations of copper to meet the new copper limits in Part I.A., Table 1 that go into effect three years from the effective date of the permit. In order to develop this plan the City may need to review its pretreatment program, monitor groundwater wells that provide source water for residential uses, monitor strategic sampling points along the facility's inflow piping from industrial users, or consider wastewater treatment systems and associated construction specifically designed for copper removal. Reports and Notifications required for submittal and the date that the new copper limits must be met are included in the Compliance Table below.

2. Interim limits in Part I.A. Table 1 for copper are in effect from the effective date of the permit until the new copper limits of 18 ug/L (average monthly concentration) and 36 ug/L (maximum daily concentration) become effective, which is three years from the effective date of the permit. Sampling for copper continues monthly throughout the permit term.

COMPLIANCE TABLE

DATE	ACTION	COMMENTS
Ongoing for the permit term.	Submit notification to ADEQ regarding upgrades to the facility that affect wastewater quality or volume as they are completed and approved by the City of Flagstaff.	The upgrades to the facility shall include descriptions of treatment train enhancements, physical changes and completed construction projects.
July 1, 2006	1ST Progress Report	The 1st Progress Report shall discuss actions taken within the past year, progress made, and timeframes for future actions.
July 1, 2007	2nd Progress Report	The 2nd Progress Report shall discuss actions taken since the 1st Progress Report, progress made, and timeframes for future actions.

DATE	ACTION	COMMENTS
December 1, 2007	Summary Report	The Summary Report shall discuss actions taken since the 2nd Progress Report, include an overall summary of activities and progress made, and indicate whether the facility is in compliance with the new copper limits of 18 ug/L (average monthly concentration) and 36 ug/L (maximum daily concentration).
July 1, 2008	The facility is required to be in compliance with the new copper limits of 18 ug/L (average monthly concentration) and 36 ug/L (maximum daily concentration).	

B

Appendix B

Pollutant of Concern: Copper
Location: Wildcat Hill WWTP
Method: Average Removal Efficiencies

Sampling Days	Sampling Dates		Concentration (mg/l)		Flow (mgd)		Loading (lb/day)		Removal Efficiency
	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	
1	10/14/03	10/15/03	0.056	0.021	3.20	3.11	1.50	0.54	64%
2	10/17/03	10/18/03	0.097	0.017	3.52	3.44	2.85	0.49	83%
3	10/18/03	10/19/03	0.023	0.017	3.67	3.60	0.70	0.51	28%
4	10/19/03	10/20/03	0.084	0.018	3.98	3.90	2.79	0.59	79%
5	10/22/03	10/23/03	0.19	0.014	4.28	4.23	6.78	0.49	93%
6	10/28/03	10/29/03	0.1	0.017	3.99	3.95	3.33	0.56	83%
7	10/29/03	10/30/03	0.07	0.017	3.81	3.77	2.23	0.54	76%
Average			0.09	0.02	3.78	3.71	2.88	0.53	

Average Daily Removal Efficiency (ADRE) [1]	**72%**
Mean Removal Efficiency (MRE) [2]	**82%**
Standard Deviation	22%
Mean + 2 Standard Deviation	125%
Mean - 2 Standard Deviation	39%

Final ADRE (without outlier)	**80%**
Final MRE (without outlier)	**84%**

Outliers Determination	
>Mean + 2StDev	<Mean - 2StDev
	outlier

Notes:
(1) ADRE = Σ (Daily Res) / # sampling days
(2) MRE = (Average Influent Loads - Average Effluetn Loads) / Average Influent Loads

Appendix B

Pollutant of Concern: **Copper**
Location: Rio de Flag WRP
Method: Average Removal Efficiencies

Sampling Days	Sampling Dates		Concentration (mg/l)		Flow (mgd)		Loading (lb/day)		Removal Efficiency	Outliers Determination	
	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent		>Mean + 2StDev	<Mean - 2StDev
1	11/03/03	11/04/03	0.082	0.0054	1.85	1.36	1.27	0.06	95%		
2	11/04/03	11/05/03	0.062	0.0088	1.83	1.78	0.94	0.13	86%		
3	11/05/03	11/06/03	0.046	0.0110	1.86	1.80	0.71	0.17	76.8%		outlier
4	11/06/03	11/07/03	0.069	0.0088	1.88	1.45	1.08	0.11	90%		
5	11/07/03	11/08/03	0.06	0.0083	1.87	1.77	0.94	0.12	87%		
6	11/08/03	11/09/03	0.052	0.0070	1.84	1.74	0.80	0.10	87%		
7	11/09/03	11/10/03	0.053	0.0100	1.81	0.92	0.80	0.08	90%		
Average			0.061	0.01	1.85	1.54	0.93	0.11			

Average Daily Removal Efficiency (ADRE) [1]	**88%**
Mean Removal Efficiency (MRE) [2]	**88%**
Standard Deviation	6%
Mean + 2 Standard Deviation	100%
Mean - 2 Standard Deviation	77.0%

Final ADRE (without outlier)	**89%**
Final MRE (without outlier)	**90%**

Notes:
(1) ADRE = Σ (Daily Res) / # sampling days
(2) MRE = (Average Influent Loads - Average Effluetn Loads) / Average Influent Loads

Appendix B

WWTP Mass Balance Calculation

Pollutant of Concern: Copper
Location: Rio de Flag WRP

	Concentration (mg/L)			Flow (mgd)			Mass Loadings (lb/d)				Ratios
							Wet Stream			Sludge	Total Sludge /
Date	Influent	Effluent	Sludge	Influent	Effluent	Sludge	Influent	Effluent	Removal	Sludge	Wet Stream Removal
11/03/03	0.082	0.0054	0.370	1.85	1.36	0.076	1.265	0.061	1.204	0.235	20%
11/04/03	0.062	0.0088	0.560	1.83	1.78	0.074	0.944	0.130	0.814	0.347	43%
11/05/03	0.046	0.0110	0.380	1.86	1.80	0.074	0.712	0.165	0.547	0.233	43%
11/06/03	0.069	0.0088	0.520	1.88	1.45	0.073	1.080	0.106	0.973	0.316	32%
11/07/03	0.06	0.0083	0.570	1.87	1.77	0.076	0.938	0.122	0.816	0.359	44%
11/08/03	0.052	0.0070	0.500	1.84	1.74	0.078	0.799	0.102	0.697	0.324	46%
11/09/03	0.053	0.0100	0.480	1.81	0.92	0.070	0.802	0.076	0.726	0.281	39%
Average Daily							**0.934**	**0.109**	**0.825**	**0.299**	**38%**
Average Daily*							**0.934**	**0.109**	**0.825**	**0.299**	
Average Mean											**36%**

Notes:
Average Daily = Average (Daily Total Sludge / Daily Wet Stream Removal)
Average Mean = Average Daily Total Sludge / Average Daily Wet Stream Removal
*Excludes days with negative removals.

Appendix B

WWTP Mass Balance Calculation

Pollutant of Concern: Copper
Location: Wildcat Hill WWTP

Date	Concentration (mg/L)			Flow (mgd)			Mass Loadings (lb/d)				Ratios
							Wet Stream			Sludge	Total Sludge /
	Influent	Effluent	Sludge	Influent	Effluent	Sludge	Influent	Effluent	Removal	Sludge	Wet Stream Removal
10/14/03	0.056	0.0210		3.20	3.11		1.496	0.545	0.952		
10/17/03	0.097	0.0170	0.360	3.52	3.44	0.062	2.846	0.487	2.359	0.185	8%
10/18/03	0.023	0.0170		3.67	3.60		0.705	0.510	0.194		
10/19/03	0.084	0.0180	0.264	3.98	3.90	0.048	2.791	0.585	2.206	0.107	5%
10/22/03	0.19	0.0140		4.28	4.23		6.779	0.494	6.285		
10/28/03	0.1	0.0170		3.99	3.95		3.326	0.560	2.766		
10/29/03	0.07	0.0170		3.81	3.77		2.226	0.535	1.691		
Average Daily							**2.881**	**0.531**	**2.350**	**0.146**	**6%**
Average Daily*							**2.881**	**0.531**	**2.350**	**0.146**	
Average Mean											**6%**

Notes:
Average Daily = Average (Daily Total Sludge / Daily Wet Stream Removal)
Average Mean = Average Daily Total Sludge / Average Daily Wet Stream Removal
*Excludes days with negative removals.

C

Appendix C
Allowable Headworks Loading Equations

AHLs based on Effluent Criteria

The AHL was calculated for the AZPDES, APP, most stringent SWQS, and AWQS effluent criteria for conservative and non-conservative pollutants by using the following equation:

$$AHL = Q_{WWTP} \times C_{effluent} \times 8.34 / (1 - ORE)$$

Where:
- AHL = Allowable headworks loading in lb/day
- Q_{WWTP} = WWTP flow for 2009 in mgd
- $C_{effluent}$ = Effluent criteria or standard in mg/L
- ORE = Overall removal efficiency
- 8.34 = Unit conversion factor [(lb/million gallons) / (mg/L)]

AHLs based on Biosolids Criteria for Land Application

The AHL was calculated for conservative pollutants by using the following equation:

$$AHL = Q_{WWTP\ biosolids} \times C_{biosolids} \times 0.0022 / ORE$$

Where:
- AHL = Allowable headworks loading in lb/day
- $Q_{WWTP\ biosolids}$ = Biosolids production for land application for 2009 in dry metric tons/day
- $C_{biosolids}$= Biosolids criteria in mg/kg dry sludge
- ORE = Overall removal efficiency
- 0.0022 = Unit conversion factor [(lb/million mg) / (kg/ton)]

AHLs based on Biofiltration, Activated Sludge and Nitrification Inhibition Levels

The AHL was calculated for the most stringent biofiltration, activated sludge, and nitrification inhibition levels by using the following equation:

$$AHL = Q_{WWTP} \times C_{inhibition} \times 8.34 / (1 - PRE)$$

Where:
- AHL = Allowable headworks loading in lb/day
- Q_{WWTP} = WWTP flow for 2009 in mgd
- $C_{inhibition}$ = Inhibition level in mg/L
- PRE = Primary removal efficiency
- 8.34 = Unit conversion factor [(lb/million gallons) / (mg/L)]

AHLs based on Anaerobic Digestion Inhibition Thresholds

The AHL was calculated for the most stringent anaerobic digestion inhibition thresholds for conservative pollutants, and for the inhibition level from the literature review for sulfides by using the following equations:

$$AHL = Q_{WWTP} \times C_{inhibition} \times 8.34 / (1 - ORE)$$

Where:

AHL = Allowable headworks loading in lb/day
Q_{WWTP} = WWTP flow for 2009 in mgd
$C_{inhibition}$ = Inhibition threshold in mg/L
ORE = Overall removal efficiency
8.34 = Unit conversion factor [(lb/million gallons) / (mg/L)]

D

Appendix D
2002 Local Limits Study - Safety Factor Calculation

Sector	Flows (mgd)		Difference	Percent difference	Annual growth rate
	1992	2000			
SIU	0.83	0.94	0.11	12.9%	1.53%
Total Influent	5.50	6.12	0.62	11.2%	1.34%

Difference 1.7% 0.19% delta in growth rates

0.19%

9 years to 2004

1.75% safety factor until 2009

[redacted]

5% Therefore use 5% for industrial growth
10% slug loadings
15% Total

E

Appendix E

SIU Pollutant Discharges Graphs

Figure B1 - SIU Copper Discharge Concentrations

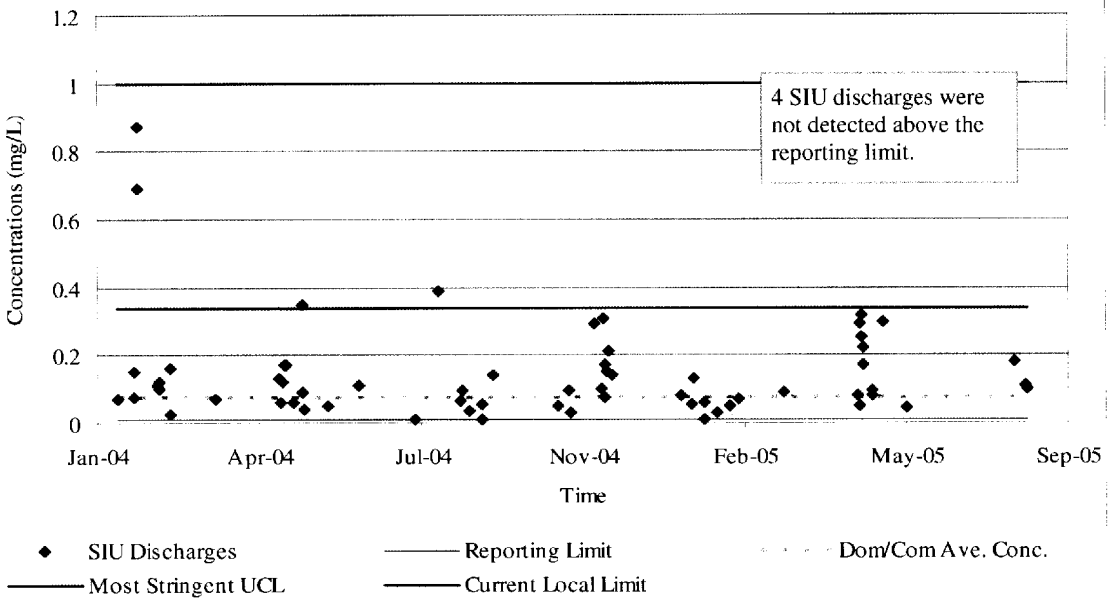


Figure B2 - SIU Cyanide (Total) Discharge Concentrations

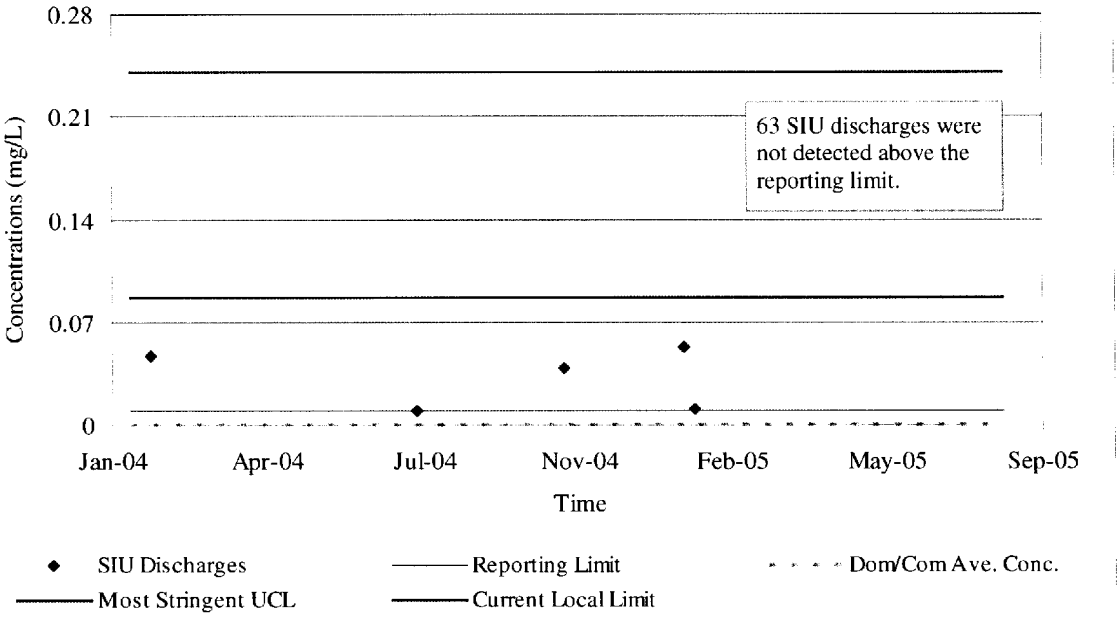


Figure B3 - SIU Lead Discharge Concentrations

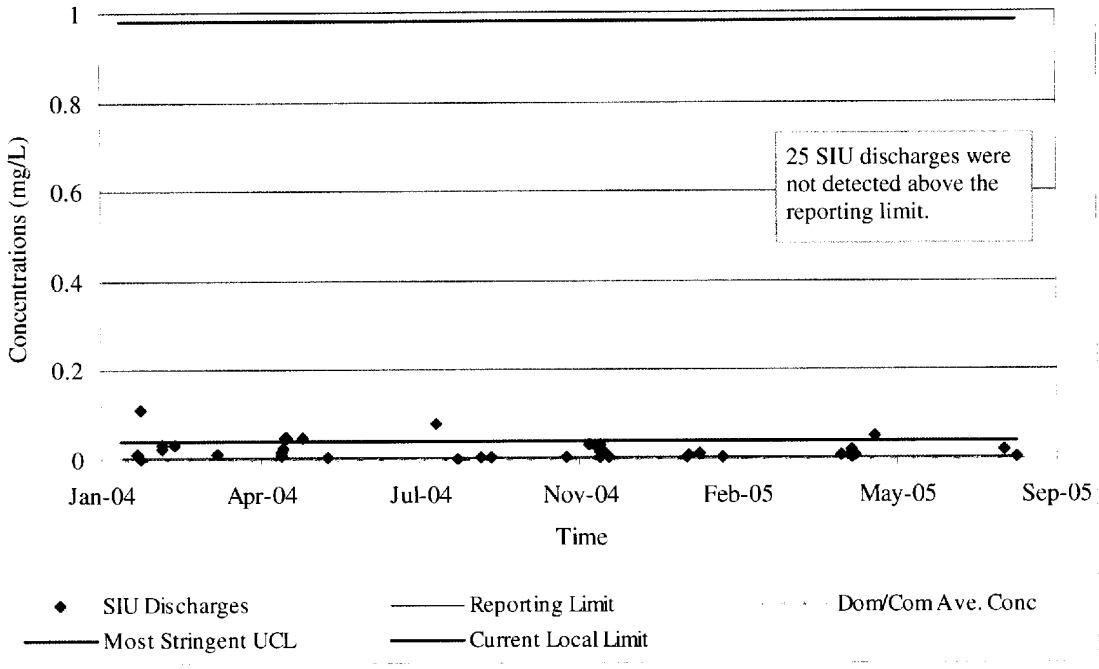


Figure B4 - SIU Mercury Discharge Concentrations

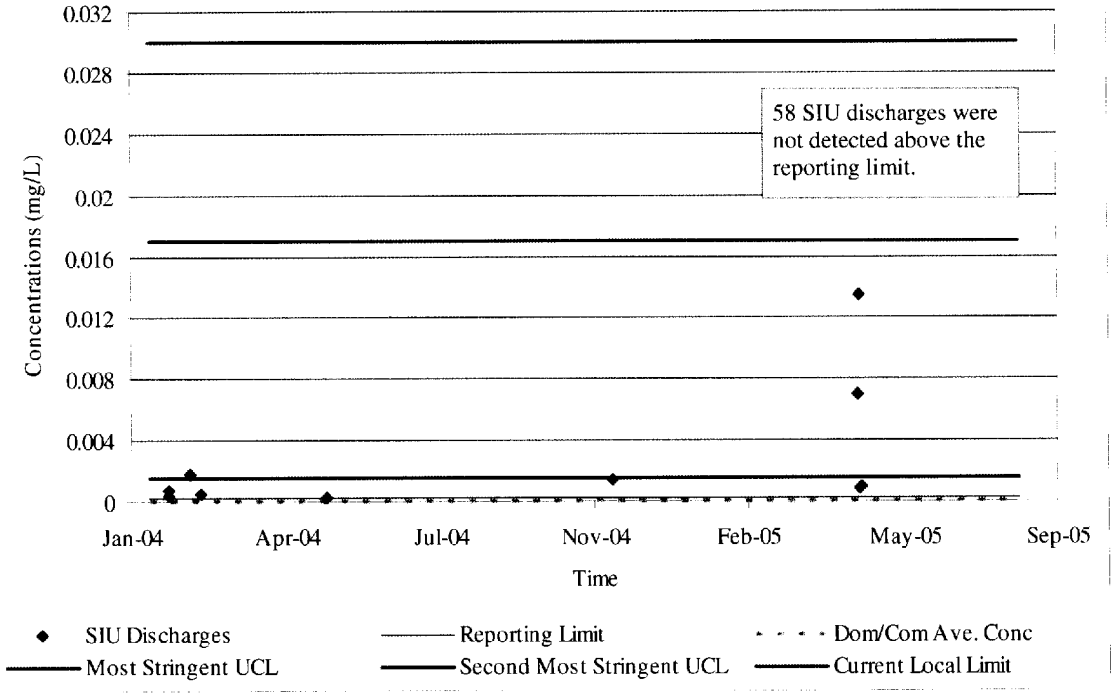


Figure B5 - SIU Selenium Discharge Concentrations

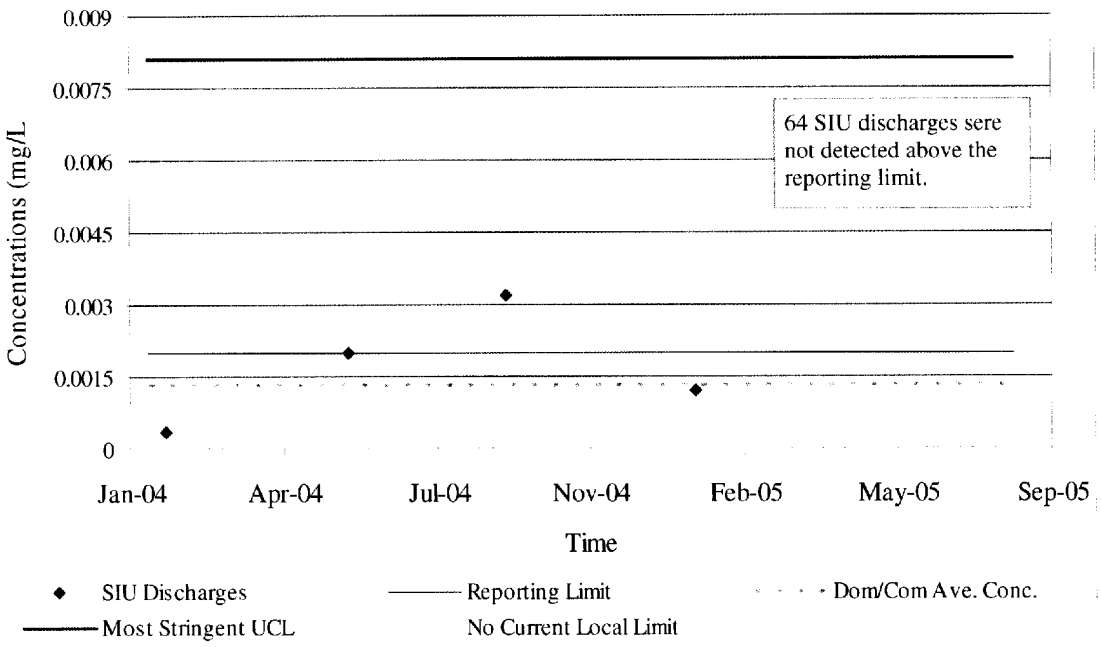


Figure B6 - SIU Silver Discharge Concentrations

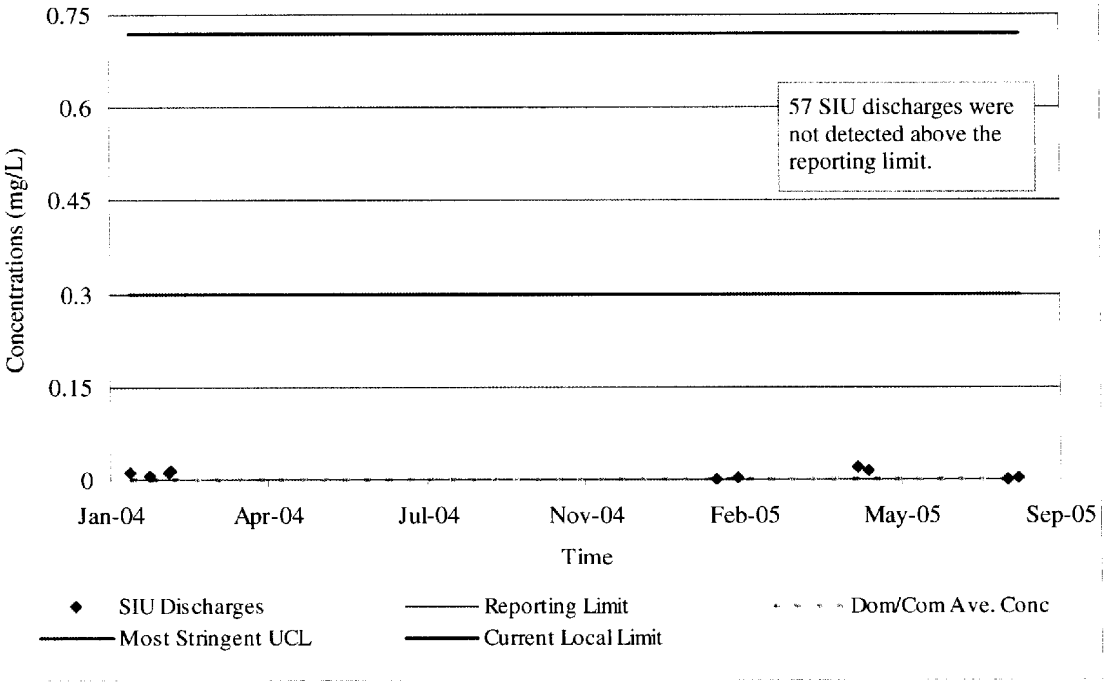
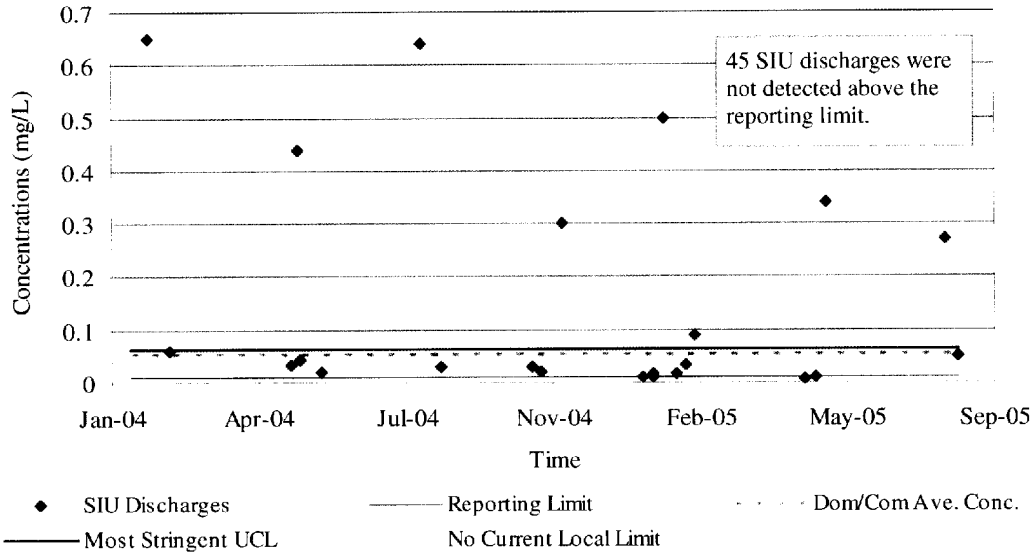


Figure B7 - SIU BEHP Discharge Concentrations



F

9.0 CONCLUSIONS AND RECOMMENDATIONS

9.1 PROPOSED ACTIONS

Twenty-three pollutants were identified as pollutants of concern for the Wildcat Hill WWTP and Rio de Flag WRP. Pretreatment limits for pH and petroleum hydrocarbons were also evaluated for this study. Allowable headworks loadings (AHLs) were determined for twelve of these pollutants. The remaining pollutants were either not suitable for analysis using the AHL method or subject to limitations based on potential explosivity and fume toxicity. Four pesticides were prohibited because they cannot be attributed to direct industrial discharges. Explosivity and fume toxicity analyses were performed for three volatile organics compounds and one pesticide to ensure protection of worker health and safety. BOD_5, TSS, and nitrogen were evaluated based on design loadings to the WWTPs. Pollutants that are health and safety issues and collection system issues such as pH and petroleum hydrocarbons, were evaluated for numerical limits based on other methods.

AHLs were calculated based upon site-specific conditions and literature values at the Wildcat Hill WWTP and at the Rio de Flag WRP, resulting in the two sets of uniform concentration limits (UCLs) which were presented in Section 6.0. To meet the goal of providing a uniform set of limits for the Flagstaff area, the more stringent value of the two for each pollutant was selected to form a common set of limits protective of both WWTPs. These limits were compared to limits based upon health and safety concerns (i.e., explosivity and fume toxicity), as discussed in Section 7.0.

Table 9-1 presents recommended local industrial pretreatment limits and proposed actions. It is generally recommended that these limits be implemented for pollutants which meet one or more of the following criteria:

- The projected influent loading exceeds ten percent of the maximum AHL based upon current limitations and criteria.
- The pollutant has health and safety impacts (i.e., explosivity or fume toxicity).

TABLE 9-1
Recommended Local Pretreatment Limits and Proposed Actions

Pollutant	Controlling Criteria		Existing Local Limit (ug/L)	Recommended Local Limit		Proposed Actions
	Source	Value (ug/L) (1)		Value (ug/L) (1)	Status	
Metals and Inorganic Compounds						
Antimony	AWQS	6	No Limit	No Limit	Interim	• Do not establish a local limit. Implementation of a calculated UCL is not recommended because it is based on background concentrations and removal efficiencies that are not site-specific. • Monitor WWTPs and collection system to obtain site-specific data for local limits analysis. Maintain detection limits of 1 ug/L for all sampling locations. • Perform mass balance calculations, removal efficiency calculations, and MAHL analyses for both treatment plants at next local limit update. • Develop and implement a source identification plan to characterize controllable (e.g., SIUs) and background sources. Perform influent mass balance analysis at next local limits update. If appropriate, identify, implement, and monitor performance of BMPs. • Re-evaluate the need for a local limit based on information from above actions during the next local limit update.
Arsenic	Federal Sludge Criteria	41 mg/kg	890	260	Final	• Implement a new local limit (260 ug/L) as a final limit. This limit is based upon defensible, site-specific data, and its implementation appears to be economically and technologically feasible. In the past two years, none of the identified industrial users have reported a discharge that would have exceeded this proposed limit. • Continue to monitor collection system and WWTPs. • Develop and implement a source identification plan to characterize controllable (e.g., SIUs) and background sources. Perform influent mass balance analysis at next local limits update. If appropriate, identify, implement, and monitor performance of BMPs.
Chromium	Nitrification Inhibition	250	900	No Limit	Final	• Eliminate existing local limit. There is a low potential for pass through and inhibition because of the low influent loading. • Continue to monitor collection system and WWTPs. • Removal efficiencies should be confirmed through the collection of additional site-specific data. • If influent loadings approach 10% of the MAHL, implement a chromium limit. • Re-evaluate the need for a local limit based on information from above actions during the next local limit update.

TABLE 9-1
Recommended Local Pretreatment Limits and Proposed Actions

Pollutant	Controlling Criteria		Existing Local Limit (ug/L)	Recommended Local Limit		Proposed Actions
	Source	Value (ug/L) (1)		Value (ug/L) (1)	Status	
Cyanide (total)	NPDES, SWQS	9.7	240	240	Interim	• Maintain the existing local limit (240 ug/L) as an interim limit. Implementation of a calculated UCL is not recommended because it is based on background concentrations and removal efficiencies that are not site-specific. • Monitor WWTPs and collection system to obtain site-specific data for local limits analysis. • Perform mass balance calculations, removal efficiency calculations, and MAHL analyses for both treatment plants at next local limit update. • Develop and implement a source identification plan to characterize controllable (e.g., SIUs) and background sources. Perform influent mass balance analysis at next local limits update. If appropriate, identify, implement, and monitor performance of BMPs. • Re-evaluate the need for a local limit based on information from above actions during the next local limit update.
Copper	NPDES	14.7	1,000	1,000	Interim	• Maintain the existing local limit (1,000 ug/L) as an interim limit. Implementation of calculated UCLs is not recommended until the status of the Administrative Order has been established and additional site-specific data has been collected. • Monitor WWTPs and collection system to obtain site-specific data for local limits analysis. • Perform mass balance calculations, removal efficiency calculations, and MAHL analyses for both treatment plants at next local limit update. • Develop and implement a source identification plan to characterize controllable (e.g., SIUs) and background sources. Perform influent mass balance analysis at next local limits update. Identify, implement, and monitor performance of BMPs. • Re-evaluate the need for a local limit based on information from above actions during the next local limit update.
Lead	NPDES	4	980	980	Interim	• Maintain the existing local limit (980 ug/L) as an interim limit. Implementation of the calculated UCLs is not recommended because they are based on background concentrations that are not site-specific, which resulted in negative UCLs. • Monitor WWTPs and collection system to obtain site-specific data for local limits analysis. • Perform mass balance calculations, removal efficiency calculations, and MAHL analyses for both treatment plants at next local limit update.

TABLE 9-1
Recommended Local Pretreatment Limits and Proposed Actions

Pollutant	Controlling Criteria		Existing Local Limit (ug/L)	Recommended Local Limit		Proposed Actions
	Source	Value (ug/L) (1)		Value (ug/L) (1)	Status	
Lead Cont.						• Develop and implement a source identification plan to characterize controllable (e.g., SIUs) and background sources. Perform influent mass balance analysis at next local limits update. If appropriate, identify, implement, and monitor performance of BMPs. • Re-evaluate the need for a local limit based on information from above actions during the next local limit update.
Mercury	NPDES	0.2	30	30	Interim	• Maintain the existing local limit (30 ug/L) as an interim limit. Implementation of the calculated UCLs is not recommended because industrial users are not likely to meet these limits without significant process modifications and prohibitive capital expenditures. Prevention of pass through can best be achieved through implementation of BMPs at commercial sources. • Monitor WWTPs and collection system to obtain site-specific data for local limits analysis. Use clean sampling techniques and laboratory methods to obtain better detection limits. • Perform mass balance calculations, removal efficiency calculations, and MAHL analyses for both treatment plants at next local limit update. • Develop and implement a source identification plan to characterize controllable (e.g., SIUs and commercial sources) and background sources. Perform influent mass balance analysis at next local limits update. If appropriate, identify, implement, and monitor performance of BMPs. • Re-evaluate the need for a local limit based on information from above actions during the next local limit update.
Nickel	AWQS	100	No Limit	No Limit	Final	• Do not establish a local limit. There is a low potential for pass through because of the low influent loading. • Continue to monitor collection system and WWTPs. Use clean sampling techniques and laboratory methods to obtain better detection limits.
Selenium	NPDES, SWQS	2	No Limit	No Limit	Interim	• Do not establish a local limit. Implementation of a calculated UCL is not recommended because it is based on background concentrations and removal efficiencies that are not site-specific. • Monitor WWTPs and collection system to obtain site-specific data for local limits analysis. Maintain detection limits of 1 ug/L for all sampling locations. • Perform mass balance calculations, removal efficiency calculations, and MAHL analyses for both treatment plants at next local limit update.

TABLE 9-1
Recommended Local Pretreatment Limits and Proposed Actions

Pollutant	Controlling Criteria		Existing Local Limit (ug/L)	Recommended Local Limit		Proposed Actions
	Source	Value (ug/L) (1)		Value (ug/L) (1)	Status	
Selenium Cont.						• Develop and implement a source identification plan to characterize controllable (e.g., SIUs) and background sources. Perform influent mass balance analysis at next local limits update. If appropriate, identify, implement, and monitor performance of BMPs. • Re-evaluate the need for a local limit based on information from above actions during the next local limit update.
Silver	NPDES	5.6	720	720	Interim	• Maintain the existing local limit (720 ug/L) as an interim limit. Although the calculated limit (62 ug/L) is based on defensible, site-specific data, implementing and strictly enforcing BMPs at major dischargers may be more effective at reducing influent loads. Three industrial users (SCA Tissue, Northern Arizona University-Biology, and Flagstaff Medical Center) have recorded at least one discharge above this proposed limit in the past two years. Flagstaff Medical Center consistently discharges above this proposed limit. • Determine whether protection of pass-through can better be achieved with BMPs rather than a stricter local limit by developing, implementing, and monitoring BMPs at the SIUs which have discharged silver above the calculated 62 ug/L limit. • Determine whether the calculated local limit is economically and technologically feasible for industrial users. • Continue to monitor collection system and WWTPs. • Develop and implement a commercial source identification plan. If appropriate, identify, implement, and monitor BMP performance. • Survey silver discharging facilities to verify that recovery units are in place and operational. Obtain hazardous waste manifests to verify proper disposal methods are being practiced. • Review BMPs for those industrial and commercial users that have silver recovery units or dispose of silver waste off-site. BMPs may need to be revised to require (a) maintenance of silver recovery systems, (b) periodic influent and effluent sampling, and (c) flow-based required efficiency as described in the *Code of Management Practices for Silver Dischargers*. • Re-evaluate the need for a local limit based on information from above actions during the next local limit update.

TABLE 9-1
Recommended Local Pretreatment Limits and Proposed Actions

Pollutant	Controlling Criteria		Existing Local Limit (ug/L)	Recommended Local Limit		Proposed Actions
	Source	Value (ug/L) (1)		Value (ug/L) (1)	Status	
Zinc	NPDES	124	7,700	1,400	Final	• Implement a new local limit (1,400 ug/L) as a final limit. This limit is based upon defensible, site-specific data, and its implementation appears to be economically and technologically feasible. In the past two years, there was only one industrial discharge (Mission Linen & Uniform-Huntington Drive) that would have exceeded this proposed limit. • Continue to monitor collection system and WWTPs. • Develop and implement a source identification plan to characterize controllable (e.g., SIUs) and background sources. Perform influent mass balance analysis at next local limits update. If appropriate, identify, implement, and monitor performance of BMPs.
Purgeables (Volatile Organics)						
Benzene	APP, AWQS	5	Prohibited	Prohibited	Interim	• Maintain prohibition of benzene. Implementation of the calculated UCL is not recommended because it is based on background concentrations and removal efficiencies that are not site-specific. • Improve best management practices and education programs with regard to benzene disposal.
Methylene Chloride	AWQS	5	No Limit	4,100	Final	• Implement fume toxicity screening level of 4,100 ug/L for methylene chloride. • Improve best management practices and education programs with regard to methylene chloride disposal.
Toluene	SWQS	180	Prohibited	4,200	Final	• Implement fume toxicity screening level of 4,200 ug/L for toluene. • Improve best management practices and education programs with regard to toluene disposal.
Base/Neutrals						
Bis(2-ethylhexyl) phthalate	AWQS	6	No Limit	No Limit	Interim	• Do not establish a local limit. Implementation of a calculated UCL is not recommended because it is based on background concentrations and removal efficiencies that are not site-specific. • Monitor WWTPs and collection system to obtain site-specific data for local limits analysis. • Perform mass balance calculations, removal efficiency calculations, and MAHL analyses for both treatment plants at next local limit update. • Develop and implement a source identification plan to characterize controllable (e.g.,

TABLE 9-1
Recommended Local Pretreatment Limits and Proposed Actions

Pollutant	Controlling Criteria		Existing Local Limit (ug/L)	Recommended Local Limit		Proposed Actions
	Source	Value (ug/L) (1)		Value (ug/L) (1)	Status	
Bis(2-ethylhexyl) phthalate Cont.						SIUs) and background sources. Perform influent mass balance analysis at next local limits update. If appropriate, identify, implement, and monitor performance of BMPs. • Re-evaluate the need for a local limit based on information from above actions during the next local limit update.
Pesticides and PCBs						
4,4'-DDD	SWQS	0.02	No Limit	Prohibited	Final	• The local ordinance should contain a prohibition on this pesticide. • Action plans should be developed to promote public education to prevent discharges of the pesticides.
4,4'-DDE	SWQS	0.02	No Limit	Prohibited	Final	• The local ordinance should contain a prohibition on this pesticide. • Action plans should be developed to promote public education to prevent discharges of the pesticides.
4, 4'-DDT	SWQS	0.001	No Limit	Prohibited	Final	• The local ordinance should contain a prohibition on this pesticide. • Action plans should be developed to promote public education to prevent discharges of the pesticides.
Heptachlor	SWQS	0.013	No Limit	Prohibited	Final	• The local ordinance should contain a prohibition on this pesticide. • Compare detected results with fume toxicity level of 3 ug/L to assess unsafe working conditions. • Action plans should be developed to promote public education to prevent discharges of the pesticides.
Others						
BOD_5	NPDES	$CBOD_5$ of 25 mg/L at WCH 30 mg/L at RDF	1,000 mg/L	1,000 mg/L	Interim	• Maintain and strictly enforce the existing local limit of 1,000 mg/L BOD5. Strict enforcement will help protect the Wildcat Hill WWTP from excessive loads and may assist in determining the causes of load variability. • Assess the BOD5 load capacity of the Wildcat Hill WWTP. The plant regularly and generally successfully treats BOD5 loads at the design capacity. The evaluation should include analysis of the performance of each process as well as the overall capability of the plant in producing an acceptable effluent quality. The results of this analysis can be used to determine if processes can be re-rated and where upgrade or expansion is required to treat projected loads. • Identify BOD5 loads; characterize variability, and update background load estimates

TABLE 9-1
Recommended Local Pretreatment Limits and Proposed Actions

Pollutant	Controlling Criteria		Existing Local Limit (ug/L)	Recommended Local Limit		Proposed Actions
	Source	Value (ug/L) (1)		Value (ug/L) (1)	Status	
BOD_5 Cont.						for both the Wildcat Hill and Rio de Flag service areas. Data should be collected to characterize wastewater discharges from commercial establishments, the Rio de Flag WRP, and non-hazardous liquid waste haulers, in addition to residences. • Further characterize flows and BOD5 loads from SIUs. The frequency of monitoring should be increased at high-load dischargers, and flow data should be collected if possible on days that BOD5 samples are collected. • Recalculate mass balances for the Wildcat Hill WWTP and the Rio de Flag WRP, using new data. • Determine needs for future growth and develop additional safety factor for the Wildcat Hill WWTP, if necessary. • Recalculate available industrial loadings for the Wildcat Hill WWTP, using updated background and SIU flow and load estimates. • Allocate available industrial loadings for the Wildcat Hill WWTP, using the mass proportion or mass reduction method. • Compare influent BOD5 loads to Rio de Flag design capacities annually. When influent loads approach 80 percent, development of local limit should be considered.
Nitrogen (Nitrate-N)	APP or AWQS	10,000	No Limit	No Limit	Final	• Do not establish a local limit for nitrogen. • Continue to monitor all forms of nitrogen (TKN, ammonia-N, nitrate-N, nitrite-N and organic N) in the plants' influent and effluent.
pH	NA	NA	Upper: 12.5 Lower: 6.0	Upper: 12.5 Lower: 5.0	Final	• Maintain the upper pH limit at 12.5. • Decrease the lower pH limit to 5.0. • Monitor and evaluate the effects on the plant's influent pH for six months to ensure NPDES limits are met.
Total Suspended Solids	NPDES	30 mg/L	1,200 mg/L	1,200 mg/L	Interim	• Maintain and strictly enforce the existing local limit of 1,200 mg/L TSS. Strict enforcement will help protect the Wildcat Hill WWTP from excessive loads and may assist in determining the causes of load variability. • Assess the TSS load capacity of the Wildcat Hill WWTP. The plant regularly and generally successfully treats TSS loads in excess of the design capacity. The evaluation should include analysis of the performance of each process as well as the overall capability of the plant in producing an acceptable effluent quality. The results of this analysis can be used to determine if processes can be re-rated and where

TABLE 9-1
Recommended Local Pretreatment Limits and Proposed Actions

Pollutant	Controlling Criteria		Existing Local Limit (ug/L)	Recommended Local Limit		Proposed Actions
	Source	Value (ug/L) (1)		Value (ug/L) (1)	Status	
Total Suspended Solids Cont.						upgrade or expansion is required to treat projected loads. • Identify TSS loads; characterize variability, and update background load estimates for both the Wildcat Hill and Rio de Flag service areas. Data should be collected to characterize wastewater discharges from commercial establishments, the Rio de Flag WRP, and non-hazardous liquid waste haulers, in addition to residences. • Further characterize flows and TSS loads from SIUs. The frequency of monitoring should be increased at high-load dischargers, and flow data should be collected if possible on days that TSS samples are collected. • Recalculate mass balances for the Wildcat Hill WWTP and the Rio de Flag WRP, using new data. • Determine needs for future growth and develop additional safety factor for the Wildcat Hill WWTP, if necessary. • Recalculate available industrial loadings for the Wildcat Hill WWTP, using updated background and SIU flow and load estimates. • Allocate available industrial loadings for the Wildcat Hill WWTP, using the mass proportion or mass reduction method. • Compare influent TSS loads to Rio de Flag design capacities annually. When influent loads approach 80 percent, development of local limit should be considered.
Petroleum Hydrocarbons	NA	NA	50 mg/L temporary	No Limit	Final	• Continue use of best management practices of good housekeeping and separation of oily wastestreams for commercial facilities. • Regulate benzene and toluene as health and safety pollutants of concern. • Eliminate the temporary 50 mg/L limit for petroleum hydrocarbon at the industrial laundries. • Develop and implement best management practices for new industrial laundries to remove free liquid from laundry prior to cleaning. • For Mission Linen and other existing SIUs, maintain and improve current pretreatment technologies as the best management practices for those SIUs that remove petroleum hydrocarbons. • Continue to monitor at least twice a year for petroleum hydrocarbons at the WWTP and at the SIUs that have had average petroleum hydrocarbon concentrations above the maximum influent concentration at the WWTPs (Northern Arizona University (Dome and Biology outfall), Mission Linen & Uniform–Huntington Drive, Flagstaff Medical

TABLE 9-1
Recommended Local Pretreatment Limits and Proposed Actions

Pollutant	Controlling Criteria		Existing Local Limit (ug/L)	Recommended Local Limit		Proposed Actions
	Source	Value (ug/L) (1)		Value (ug/L) (1)	Status	
Petroleum Hydrocarbons Cont.						Center, Ralston Purina, and Peps -Cola Bottling Company) using the Modified Method 8015 such that fingerprinting and investigations of spills/occurrences can be facilitated. • If the City chooses to implement a limit of 100 mg/L for petroleum hydrocarbons, the test method to be used is 1664A such that it can be compared to other cities. The 100 mg/L local limit would be protective of the plant although not based on site-specific data.

(1) Units are in ug/L unless otherwise stated.

Note: NA = Not Applicable

It is further recommended that the existing local limits for two pollutants, phenol and cadmium, be eliminated because these pollutants were not identified as a concern from the review of sampling data and EPA screening. The industries are not pretreating their discharges to remove phenol; therefore, the elimination of the limit should not cause an increase of phenol to the WWTPs. Continued monitoring at the plants is recommended. The known industrial dischargers of cadmium have in-place pretreatment technologies that will not change if the cadmium limit is eliminated. For cadmium, it is also recommended that the City determines if lower detection limits can be achieved at the WWTPs and to continue monitoring so that the pollutant can be evaluated in future studies. Refer to Section 2.4 for more detail.

For the secondary pollutants of concern, it is recommended that the City:

- Determine whether lower detection limits can be achieved for those secondary pollutants of concern that have detection limits greater than effluent criteria.

- Monitor at the WWTPs those secondary pollutants of concern for which regulatory and/or environmental criteria exist but which are not routinely analyzed at the WWTPs.

As a result of the evaluation discussed in Section 6.2, the metals, inorganic compounds, and base-neutrals that were analyzed with the headworks allocation method were divided into three groups based on the level of risk to the WWTPs:

- Group 1 - Observed influent loadings greater than 100% MAHL: copper, mercury, selenium, silver, and bis(2-ethylhexyl) phthalate. The WWTPs have a high potential for pass through and non-compliance with permit limitations. Source identification and control of these pollutants with a local limit and/or best management practices should be a high priority.

- Group 2 - Observed influent loading between 10% and 100% MAHL: antimony, arsenic, cyanide, lead, and zinc. The WWTPs have a potential for pass through and non-compliance with permit limitations. Source identification and control with a local limit and/or best management practices of these pollutants should be an on-going effort.

- Group 3 - Observed influent loading below 10%: chromium and nickel. The WWTPs have a low potential for pass through and non-compliance with permit limitations. Continued monitoring, source identification, and re-evaluation of need of a local limit should be an on-going effort.

The action plans for the Group 1, 2, and 3 pollutants include collection and analysis of additional site-specific data as well as developing source identification plans. These action plans should be implemented at this time in order to update the local limits in conjunction with the renewal of the Wildcat Hill WWTP and the Rio de Flag WRP NPDES permits in November 2004, as required in 40 CFR 403.5 (c). A proposed implementation schedule is described in 6.3, Sampling and Future Analyses.

The W.L. Gore 4th Street facility was included in these technical analyses as contributing primarily to the Rio de Flag WRP; however this small facility (8,700 gpd) is located solely in the Wildcat Hill WWTP service area. This difference does not affect the recommendations in this study. During the next local limits update, the evaluation should be conducted with the W.L. Gore 4th Street facility being located in the Wildcat Hill WWTP service area.

Table 9-1 presents the specific limit recommended for each pollutant of concern. The rationale for selection and implementation of specific limits is as follows:

- If a pollutant is currently regulated by a local limit, the controlling limit is more stringent, and there are extenuating circumstances (e.g., the assumptions and estimates used in the AHL analysis require additional verification or supporting data), the existing limit is maintained as an interim limit, if it protects the NPDES limit, until these needs are met and a new limit is determined.

- If the existing limit is not protective, the controlling limit (or some modification thereof) is implemented as an interim limit until needs are met and the limit is finalized.

- If a pollutant is not currently regulated by a local limit and there are extenuating circumstances (as above), implementation of the controlling limit is not established on an interim basis until these needs are met and a new limit is determined.

- If a pollutant is not currently regulated by a local limit and there are no extenuating circumstances, the controlling limit is implemented.

The following discussion is based upon the controlling criterion for each pollutant. Where implementation of the controlling limit is recommended, it stands that all other criteria are protected. Thus, if the controlling criterion is the NPDES permit limitations, APP permit limitations, state Water Quality Standard (SWQS), process inhibition limitations, sludge quality concerns, and worker health and safety requirements are protected as well. Needs and proposed actions in response to extenuating circumstances are also discussed. Interim limits were

recommended in cases where the degree of confidence in the assumptions upon which AHL calculations were based is low.

9.2 SUMMARY

Recommended local limits are summarized in Table 9-2. This table presents the proposed numerical limitations for each pollutant and indicates the status (i.e., final or interim) of the limit.

TABLE 9-2
Summary of Recommended Local Pretreatment Limits

Pollutant	Existing Local Limit (ug/L) (1)	Proposed Local Limit (ug/L) (1)	Status of Proposed Local Limit
Metals and Inorganic Compounds			
Antimony	No Limit	No Limit	Interim
Arsenic	890	260	Final
Chromium	900	No Limit	Final
Cyanide (total)	240	240	Interim
Copper	1,000	1,000	Interim
Lead	980	980	Interim
Mercury	30	30	Interim
Nickel	No Limit	No Limit	Final
Selenium	No Limit	No Limit	Interim
Silver	720	720	Interim
Zinc	7,700	1,400	Final
Purgeables (Volatile Organics)			
Benzene	Prohibited	Prohibited	Interim
Methylene Chloride	No Limit	4,100	Final
Toluene	Prohibited	4,200	Final
Base/Neutrals			
Bis (2-ethylhexy)phthalate	No Limit	No Limit	Interim
Pesticides and PCBs			
4,4'-DDD	No Limit	Prohibited	Final
4,4'-DDE	No Limit	Prohibited	Final
4,4'-DDT	No Limit	Prohibited	Final
Heptachlor	No Limit	Prohibited	Final
Others			
BOD_5	1,000 mg/L	1,000 mg/L	Interim
Nitrogen (Nitrate-N)	No Limit	No Limit	Final
PH	Upper: 12.5 Lower: 6.0	Upper: 12.5 Lower: 5.0	Final
Total Suspended Solids	1,200 mg/L	1,200 mg/L	Interim
Petroleum Hydrocarbons	50 mg/L Temporary	No Limit	Final

(1) Units are in ug/L unless otherwise stated.